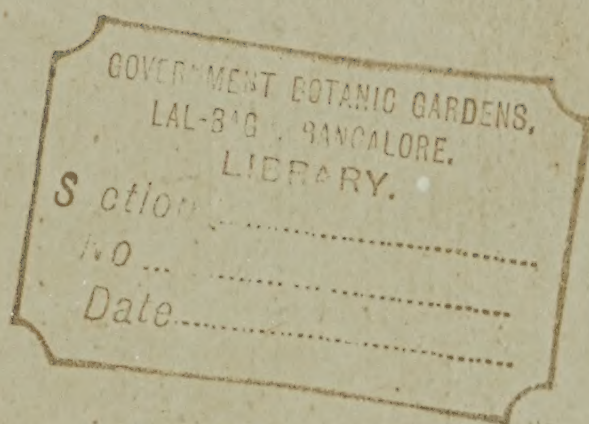


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ON THE OCCURRENCE OF MAIZE RUST IN THE PHILIPPINES ¹

By GAUDENCIO M. REYES

On June 26, 1923, Mrs. Mary Strong Clemens, who is making a collection of Philippine fungi, found a certain disease of corn, and some specimens were very kindly presented to the writer. The disease was collected at an altitude of 3,000 to 4,000 feet, near the gold mining camp of the Benguet Consolidated Mining Company at Antamok, Baguio, Mountain Province, Luzon.

Mrs. Clemens believed that the disease was a rust caused by *Puccinia sorghi* Schw. On consulting the List of Known Philippine Fungi by P. L. Ricker in the Philippine Journal of Science, Vol. 1, pp. 277-294, (Supplement) 1906; Lower Fungi of the Philippine Islands by C. F. Baker in Leaflets of Philippine Botany, Vol. 6, Art. 102, pp. 2065-2190, 1914, and Vol. 8, Art. 113, pp. 2417-2542, 1914; the Host Index of Philippine Fungi by Harry S. Yates, 1919 (unpublished); O. A. Reinking's Host Index of Diseases of Economic Plants in the Philippines, in the Philippine Agriculturist, Vol. 8, pp. 38-54, 1919; a Provisional List of the Parasitic Fungi of the Philippine Islands by Colin G. Welles in the Philippine Agricultural Review, Vol. 15, pp. 149-202, 1922; and, also, the accession register of Philippine fungi at the Bureau of Science, it was found that this disease had not hitherto been reported in the Philippines. Apparently this is the first collection of plants with this malady in the Philippines and no record exists of preserved material. Nothing could be said as to the origin of this disease as no authentic data is available. However, the writer learned that American sweet corn, introduced from California, is being grown in Trinidad, Baguio, from a letter of Mr. M. Manas y Cruz, Chief of the Plant Industry Division, Philippine Bureau of Agriculture.

¹ Contribution from Plant Pathology Laboratory.

² The writer is greatly indebted to former Director E. D. Merrill of the Philippine Bureau of Science for the use of the laboratory, and other facilities, especially the mycological and pathological herbarium. Thanks are also due to Dr. Nicanor G. Teodoro, Incharge of Plant Pathology Laboratory, Philippine Bureau of Agriculture, for suggestions and criticisms.

Sweet corn is the most susceptible species to corn rust according to the inoculation experiments conducted by Weber⁽¹³⁾ at the University of Wisconsin.

This work was undertaken mainly as an attempt at identifying the fungus. Later, when opportunity permits, further observations will be made to determine definitely its distribution and seriousness in the Philippines. Studies will be made on some other phases also, such as etiology, inoculation work, the heteroecious character of the causal fungus, and control experiments.

DISTRIBUTION AND ECONOMIC IMPORTANCE

According to information received from Mrs. M. S. Clemens and from Mrs. Florence V. W. Kettenbach who made a survey and collection of the disease, the corn plants were more or less all infected and they did not mature well, probably because of the rust. It was also observed that the disease was particularly injurious on the lower leaves. In severe cases, Cook⁽³⁾ reports that the leaves die prematurely and the value of corn as forage is thereby lessened. Duggar⁽⁴⁾ states that it affects the leaves and leaf sheaths and may cause great damage to the growth of the inflorescence. Arthur⁽¹⁾ mentions that the corn rust is a persistent parasite and lives on the plant as long as it is alive. Although the rust on Philippine maize may not be considered of great economic significance at present because its occurrence appears to be local, it might become so when exceptionally favorable weather conditions obtain. So far, it is known to exist only in Baguio but further survey may reveal its presence in other localities.

DESCRIPTION OF THE DISEASE

The disease is characterized by the presence of small pustules, commonly elongated, and scattered profusely over the leaf (Plate I). Sometimes the pustules are found in the center of spots with clay colored centers and deep brownish drab borders, and a yellowish zone around. The center of the spot may also be of a grayish brown color with argus brown margin. Some spots coalesce and one or more of the pustules may be found in the center. The pustules may appear also on the green parts of the leaves without the slightest discoloration of the surrounding area (Plate II). They are more commonly produced on the upper surface of the leaf. They develop in the leaf tissue and elevate the epidermis which finally, when spores mature, bursts open, the fissure (Plate II) being in the direction of the leaf veins, and the powdery mass of spores come out.

The symptoms of rust on the Philippine maize greatly resemble the symptoms of preserved specimens of the same disease on corn contributed to the mycological herbarium of the Bureau of Science by the United States Department of Agriculture.

CAUSAL ORGANISM

Puccinia sorghi Schw., causing the corn rust, is said to have been reported as early as 1815, according to Stevens(12); and Duggar(4) believes it is indigenous to America. It is also known as *Puccinia maydis* Bereng., in Australia(6), and in India(2). *P. sorghi* is the first and only disease of maize that has ever been reported from Uganda according to Snowden (13). Saccardo(9) listed its synonyms as reported in the literature, and reported its occurrence on maize and sorghum in some countries of Southern Europe and in Somerset, East Africa. The rust on maize and sorghum are now considered to be different by Duggar(4), and by McAlpine(6) cited from Sydow's Monograph.

Careful microscopic study has shown that the pathogene on the Philippine maize rust agrees very closely with the description of the corn rust organism previously reported from the United States, Australia, and India.

Both uredospores (II) and teleutospores (III) were found but the latter were somewhat scarce. Under a hand lens the teleutosori appear darker in color than the uredosori. The uredosori are reddish brown while the teleutosori are much darker or almost black.

The uredosori are numerous, scattered or in groups, elliptic or oblong, raised, and occasionally confluent.

Uredospores (Plate III) are globose to ovoid, generally with four germ-pores and covered with short and tiny wart-like projections. The immature uredospores are hyaline while the mature spores are buff-yellow to light orange-yellow. Uredospores from fresh material measure 24.05–35.52 x 23.69–30.71 microns based on 20 measurements. They germinate in water or in sugar solution in drop cultures.

The teleutosori are few, scattered, oblong, and sometimes confluent.

The teleutospores (Plate IV) are smooth, two-celled, chestnut-brown, especially the upper cell, which is generally a little larger than the lower cell, thickened at the apex (5.92–7.4 microns thick); apex rounded or somewhat papilliform; pedicels long, brownish, 5.5–7 microns wide, and thickened at the point of attachment with the spores. The teleutospores measure 33.30–42.18 x 20.72–26.64 microns. Mesospores are present (Plate IV).

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According to a systematic arrangement of rust as briefly described by McAlpine(6), the teleutospores of *Puccinia* are two-celled, with horizontal septum, and have only one germ-pore in each cell. These distinguishing morphological characters are present in the teleutospores of the Philippine maize rust and the last characteristic was observed plainly when boiling some teleutospores in an equal proportion of glycerine and lactic acid on a slide for a few seconds over an alcohol flame, and then allowing the mount to cool down before examining under a microscope. Likewise two other formulæ were tried and they proved equally good for detecting both uredospores and teleutospores for germ-pores. One formula consisted of lactic acid, 1 part; phenol, 1 part; glycerine, 1 part; and distilled water, 1 part. The other formula used was a mixture of equal parts of lactic acid and phenol. These two different mixtures showed the germ-pores in teleutospores but not as distinctly as in uredospores.

The measurements made by Saccardo(9), McAlpine(6), and Butler(2) of uredospores and teleutospores vary somewhat but their measurements are very nearly approached by the writer's. The causal fungus is unquestionably *Puccinia sorghi* Schw.

It is worthy to remark that an imperfect fungus, *Darluca filum* (Biv.) Cast., was found associated frequently with the uredosori and occasionally with the teleutosori. The genus *Darluca* is mentioned by Stevens(11) as a fungus commonly found parasitic on rust fungi; and McAlpine(6) claims that *D. filum* attacks the mycelium, and presumably, he says, it prevents the formation of spores. It has been recorded upon 24 per cent of the *Puccinia* species(6).

The pycnidia or sporing bodies of *D. filum* are minute, black, gregarious, much darker or opaque around the ostiolum, globose, surface reticulate, and with very short or no neck.

The conidia are numerous, two-celled, with a transverse septum, not constricted at septum, hyaline, fusiform, and measure from about 13.6–18.5 microns in length and about 3.7 microns in width. These morphological characters conform very closely with the preserved specimen of *Darluca filum* (Biv.) Cast., on *Puccinia magnusiana* Korn., on *Phragmites communis* Trin., in the mycological herbarium of the Philippine Bureau of Science.

DISSEMINATION OF THE DISEASE

The disease may be disseminated by the wind, rain, insects as well as other animals, or by some other agents. It is also

probable that the disease is spread by seeds. Manns and Adams(5) proved by means of cultural and histological studies that parasitic fungi are carried in the kernel of corn. The four fungus parasites they found living inside the corn seed and inhibiting germination were: *Cephalosporium sacchari* Butler; *Fusarium moniliforme* Sheldon; *Gibberella saubinetii* (Mont.) Sacc.; and *Diplodia zeae* (Schw.) Lev. Whether or not seeds infected with these pathogenes will develop diseased plants when sown remains to be proved. In connection with Manns and Adams(5), studies, species of the genera *Aspergillus*, *Cladosporium*, *Penicillium*, *Alternaria*, *Helminthosporium*, *Rhizopus*, *Spicaria*, *Hormodendrum*, *Torula*, *Chaetonium*, *Colletotrichum*, and also some bacteria have been found occasionally associated internally with seed corn. Although rust caused by *Puccinia sorghi* Schw. was not included in their work, the writer is inclined to believe that it is also carried by seed. This remains to be proved, however.

HETERŒCISM

Corn rust has long been considered heterŒcious. The æcidial stage has been found on several species of the genus *Oxalis*. According to Arthur(1), there are seven or eight records of the collection of æcidia on *Oxalis* and in each case it is believed that the æcidium was connected with *Puccinia sorghi* Schw. He succeeded in producing corn rust by inoculating with æcidiospores from æcidia of *Oxalis cymosa* Small. McAlpinne(6) believes that the *Oxalis* was infected from the teleutospores of *P. maydis*. The heterŒcious character of maize rust was further established, according to Butler(2), by cross-inoculation of *Oxalis* leaves with sporidia produced from teleutospores of *Puccinia maydis* Bereng., and of maize leaves by using æcidiospores from *Oxalis*.

The other complimentary hosts mentioned in the literature and listed by Arthur(1) are: *Oxalis bowiei* Lindl., *O. Violacea* Linn., *O. stricta* Linn., and *O. corniculata* Linn. A closely related grass to maize, *Euchlaena mexicana* Schra., was found susceptible to the attack of *P. maydis* in India(2). In the Philippines, Merrill(7) reports that there are two species of *Oxalis*, a genus of the *Oxalidaceae* (*Oxalis* or Balimbing Family), one of which, *Oxalis repens* Thunb., is very common throughout the Philippines and grows in places higher than where the corn rust was observed. It is frequently confused with *O. corniculata* Linn., he says. Its local names are "tainṅandaga," "susokoyili" (Tag.),

“marasiksik” (Ilk.), and “salamagi” (Bon.). It is quite safe to suppose that these plants might be liable also to the attack of corn rust. Some plants of *O. repens* were sprayed with an atomizer in the laboratory on August 17, 1923, with teleutospores diluted in sterile water from rusted corn leaves collected on the 26th of June, 1923, but after fourteen days there were no effects apparent. On September 26, 1923, an attempt was made to infect corn plants of a native yellow flint variety with both uredospores and teleutospores from the material collected in June, 1923, by cutting portions of the rusted leaves with ruptured sori and placing them on the upper surface of the leaves, supplying an extra moisture with the aid of moist cotton. After 24 days no evidence of infection was produced both in the infected and control plants. It seemed that the fungus has lost its vitality due to drying. However, inasmuch as no spores were allowed to germinate in a moist chamber as a check, the result obtained is rather unconvulsive. Moreover, this experiment was carried out in the open air where the temperature (about 30° C.) was not probably favorable for the spores to germinate, and to cause an infection. In a reference which the writer came across, lately, Weber(13) reports that urediniospores hardly germinated at 30° C., and they did not cause an infection on the corn plant at that temperature. Experiments in this direction will be conducted when fresh material is found. No life histories of rusts occurring in the Philippines have yet been studied.

CONTROL

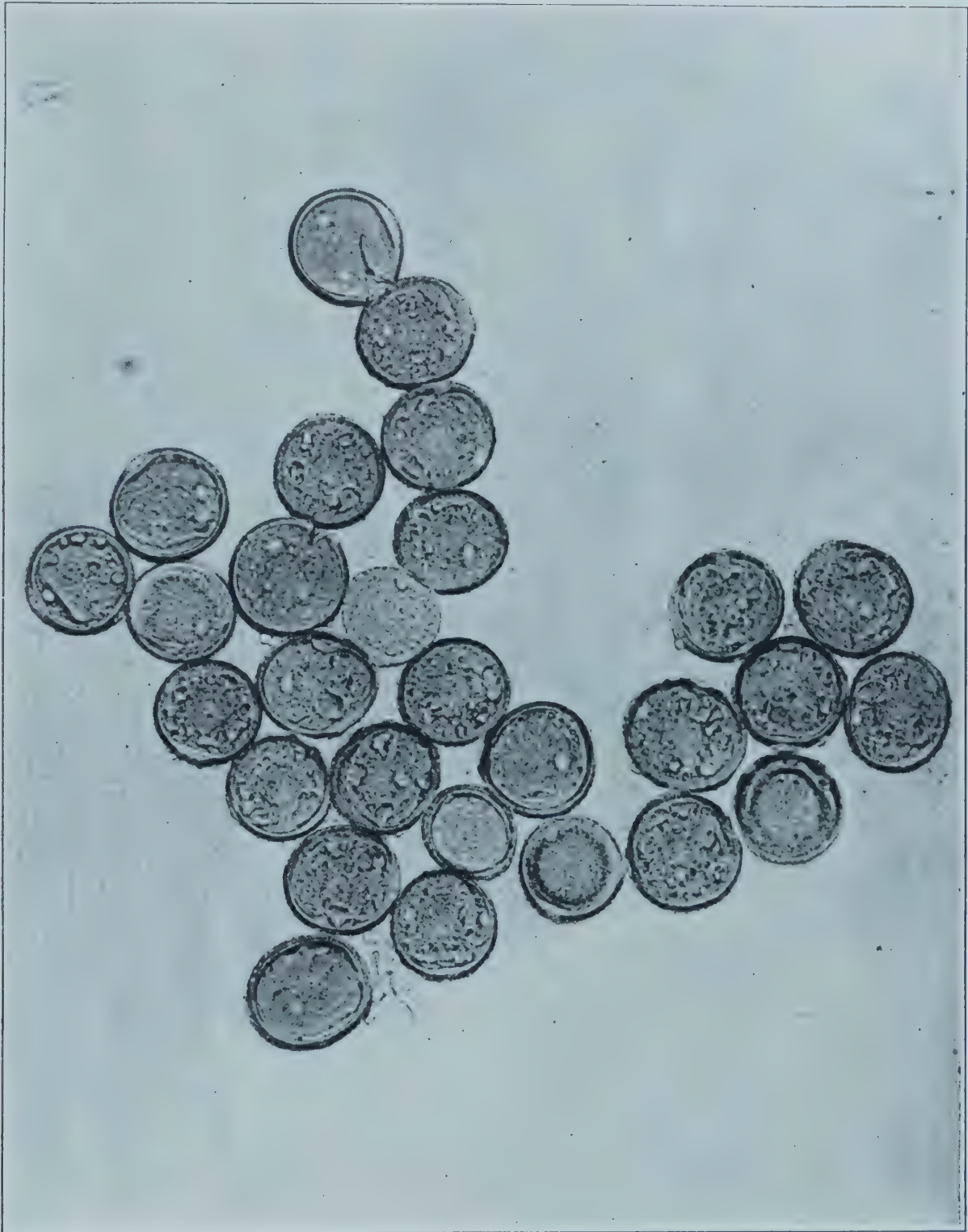
As far as the writer knows, no control measure for corn rust is recommended in the literature. Corn is not a permanent crop and therefore crop rotation could be easily practised if the disease became severe. Its life cycle should be studied and upon discovery of its intermediary host, a control measure similar to barberry eradication to mitigate loss from wheat rust may be urged. Variety resistance would also be a beneficial measure to be followed. Weber(13) found both in his observations in the field and in his artificial inoculation experiments that sweet corn ranks first in the degree of susceptibility to corn rust. The less susceptible species which resulted from his inoculation work are: *Zea everta* (pop corn), *Z tunicata* (pod), *Z. ramosa*, and *Z. indentata* (dent). Manns and Adams(5) found no successful method of seed disinfection for internal parasites of seed corn.



A portion of corn leaf infected with rust showing sori, $\times 2$.



A close view of a portion of corn leaf showing spots and much enlarged sori of *Puccinia sorghi* Schw., and the way the fungus spores rupture the epidermis, $\times 7$.



A photomicrograph of young and mature uredospores of *Puccinia sorghi* Schw., from corn showing on some of them the tiny spine-like projections and germ-pores. Taken from a water mount from three-months specimen. $\times 350$.



A group of teleutospores and mesospores of *Puccinia sorghi* Schw. Note the long pedicels, $\times 350$.

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THE EFFECTS OF TOBACCO DUST AND LIME ON BARIT ¹

By VICTORINO BORJA, *Agronomist, Alabang Rice Station*

In an experiment conducted at the Alabang Rice Station to find out the proportions in which tobacco dust and lime may be combined and applied to barit, the amount of lime used was based on the experience with Alabang soils,² where applications of 200 to 500 kilos to the hectare have given good results; and also on the requirement of the Internal Revenue Bureau that at least 20 per cent of lime be added to the tobacco dust.

Three adjacent paddies ("checks") having about the same kind of soil and irrigation facilities, were selected. Throughout the period of experimentation a uniform depth of water was kept in all.

The application of the mixtures were made on May 8, 1920, when the grass had just been cut and had not yet formed whole leaves.

Each paddy was divided into three sections. In the first two duplicate paddies, sections marked I-a and II-a were used as control; sections I-b and II-b were treated with a mixture containing 90 per cent tobacco dust and 10 per cent commercial lime, applied at the rate of 2 metric tons per hectare; and sections I-c and II-c were treated with a mixture containing 85 per cent tobacco dust and 15 per cent lime, applied at the same rate. Section III-a, in the third paddy, served as control. Section III-b was given a mixture containing 95 per cent tobacco dust and 5 per cent lime, at 2 metric tons per hectare; and section III-c, a mixture containing 80 per cent tobacco dust and 20 per cent lime, at the same rate.

Arrangement of sections in three paddies

I-a	II-a	III-a
I-b	II-b	III-b
I-c	II-c	III-c

¹ Barit, *Leersia hexandra* Swart.

² Alabang soils according to an analysis contain 0.137 per cent nitrogen, 0.1 per cent phosphorus anhydride, 0.045 per cent potash, 0.263 per cent lime, and 0.83 per cent humus; acid reaction.

Observations made on the the first week following the treatment showed a distinct yellowing of the plants in all sections receiving less than 15 per cent lime in the mixture. This discoloration was particularly pronounced in section III-b where the mixture applied contained only 5 per cent lime.

In the second week, however, the plants of all the treated sections began to grow vigorously, and their normal color reappeared.

The crops reached full maturity July 5, 1920. The yields of grass were as follows:

TABLE I.—*Showing the yields of the duplicate paddies. Mixtures applied at the rate of 2 metric tons per hectare*

Section No.	Mixture containing	Area of section	Yield of section	Estimated yield per hectare	Estimated average yield per hectare
		<i>Sq. m.</i>	<i>Kilos</i>	<i>Kilos</i>	<i>Kilos</i>
I-a.	None.	111.94	176.4	15,758.4	{ 15,381.1
II-a.	do.	117.17	175.8	15,003.8	
I-b.	Tob. dust, 90 per cent; lime, 10 per cent.	92.38	164.0	17,752.8	{ 17,788.5
II-b.	do.	107.27	191.2	17,824.2	
I-c.	Tob. dust, 85 per cent; lime, 15 per cent.	116.37	216.37	18,578.6	{ 18,185.0
II-c.	do.	124.78	222.0	17,791.3	
III-a.	None.	116.30	182.5	15,692.2	.....
III-b.	Tob. dust, 95 per cent; lime, 5 per cent.	112.46	213.0	18,940.0	.....
III-c.	Tob. dust, 80 per cent; lime, 20 per cent.	113.96	297.4	26,096.9	.....

In comparing the average yields per hectare of sections I-a and II-a (Table I), with those of sections I-b and II-b, and, again with those of I-c and II-c, it will be seen at once that there was an increase over the control of 2,407.4 kilos (15.6 per cent) and 2,803.9 kilos (18.2 per cent) of the sections treated with the mixture containing 90 per cent tobacco dust and 10 per cent lime, and with the mixture containing 85 per cent tobacco dust and 15 per cent lime, respectively. The last increase would have been greater but for the fact that the stand of the grass in section II-c was thin, which must have brought the normal average down by something like 5 per cent.

The effects of treatment in sections III-a, III-b, and III-c were greater proportionally, as the figures will show. While the yield of the control section III-b was practically the same as for the corresponding sections I-a and II-a the gain obtained in section III-b was 3,247.8 kilos (20.8 per cent), and 1,040.7 kilos (66.3 per cent) in section III-c.

The yields thus increased with the increased proportions of lime in the mixtures. Just how much of the benefit was due to the tobacco dust could not be ascertained by this experiment. It appears though that there was none, except for the part it might have played as an insecticide with reference to the grass just as lime might have done with reference to the tobacco dust.

To summarize the results:

(1) Where lime in the mixture was less than 15 per cent the tobacco dust was at first inimical to the growth of barit. But the effect was only temporary and could be neutralized with the use of 20 per cent lime in the mixture.

(2) The increase of yields was due chiefly, if not solely, to the addition of lime, it being proportional to the amounts of lime contained in the mixtures.

(3) Everything considered, the mixture which gave the best results was the one containing 80 per cent tobacco dust and 20 per cent lime. The minimum limit to which lime might enter in combination with tobacco dust should be 15 per cent. With less there might be danger of the irritating effects of tobacco dust.

(4) Lime alone may be applied to barit to advantage.

SIZE OF SEEDLING TESTS WITH SPECIAL REFERENCE TO THE RATE OF SEEDING AND RELATIVE YIELDS

By JUAN P. TORRES, *Assistant in Agronomy, Alabang Rice Station*¹

INTRODUCTION

There is a difference of opinion among our rice growers relative to the method of transplanting large or vigorous and weak or under-sized seedlings. Many of them have not realized yet the advantages of one type of seedlings over the other and they believe that it makes no difference at all whether they should transplant large or small seedlings. So, they sow their seeds rather too thickly. Consequently, they produce small and less vigorous seedlings. A few farmers, however, seem to know by experience the fact that weak plants give comparatively smaller yield than vigorous ones.

Borja² in 1918, experimenting with big as against ordinary sized seedlings of the variety Pauni, No. 663, found that the former gave a 96 per cent stand and a yield of 2,065.6 kilograms to the hectare, as against the latter, 83 per cent stand and 1,725 kilograms of yield obtained from the latter.

Nowadays, the rate of seeding generally used is one cavan (43.6 kilograms) seeds to 333 square meters or one kilogram to approximately 8 square meters of seedbed. At this rate however the seeds must have 100 per cent germination or close to it, although 75 per cent germination may be enough.

The object of this article is to furnish a guide as to the proper rate of seeding and to determine the superiorities of the large seedlings over the small ones of the same age together with the effect of the rate of seeding upon the yields of transplanted rice.

This experiment was begun in July, 1922, and was performed in a portion of field A of the Alabang Rice Station, Alabang, Rizal. This portion of the field, which has a heavy clay soil, had just been used for seed-bed.

METHODS OF EXPERIMENTS AND MATERIALS USED

Ten plots, of two square meters each, were prepared in a paddy in field A in two rows of five plots each, and serially designated plots A, B, C, D, and E. They were raised about one

¹ Mr. Torres is now a government student in the United States.

² 1918 Annual Report of Alabang Rice Station.

centimeter above the surface of the rest of the paddy, the tops were leveled off. The varieties Ramai, No. 1225, and Tadung, No. 1258, were used. Samples of seeds were first tested for germination, and the quantities of seeds corresponding to the rate of seeding shown in Table I, were weighed out. On July 8, the seeds were placed under water for about eighteen hours to start germination and on the following day scattered uniformly in each of the plots.

Ramai alone was used for the determination of the number of each of the two kinds of seedlings (large and small) from each rate of seeding. Thirty days from sowing, the seedlings were carefully pulled up and thoroughly cleaned from soil, and the excess water removed. Five bundles of 200 grams each were weighed from each lot and counted for the number of large seedlings only considering the width of its base. See Table I. Those of two millimeters or less (flat-crosswise diameter) were considered small seedlings and those wider were counted as large.

Two thousand sound seedlings each of the large and small kinds were selected from each variety. Large seedlings were taken from their plots A and the small from plots E. The seedlings were transplanted on August 10, 1922, one plant to the hill and the hills were set 20 centimeters apart each way. This spacing was maintained by means of small chains of twenty-centimeter links. Alternated with every two rows of large seedlings were two rows of the other kind. One row consisted of one hundred plants. Fillers of the same varieties were planted next to the outside rows of the tests.

When the plants reached maturity each was tied up separately and cut down as close to the ground as possible. Then individual plant records as to length and number of culms and the weight of grains were taken.

TABLE I.—*Number and percentages of large and small sized seedlings as affected by the rate of seeding*

Rate of seeding	One cavan to—									
	A-200 sq. m.		B-170 sq. m.		C-140 sq. m.		D-120 sq. m.		E-60 sq. m.	
<i>Bundles</i>	<i>Large</i>	<i>Small</i>	<i>Large</i>	<i>Small</i>	<i>Large</i>	<i>Small</i>	<i>Large</i>	<i>Small</i>	<i>Large</i>	<i>Small</i>
First.....	282	75	238	194	106	410	138	450	62	412
Second.....	276	68	189	162	177	207	128	317	100	460
Third.....	344	45	356	174	141	237	83	438	89	466
Fourth.....	245	39	236	156	138	397	145	422	49	592
Fifth.....	224	75	196	55	124	203	74	519	94	394
Total.....	1,271	302	1,115	745	686	1,444	568	2,146	394	2,324
Percentages.	81	19	60	40	32	68	21	79	15	85

DESCRIPTION AND DISCUSSION OF RESULTS

One cavan to two hundred square meters, had produced 81 per cent of large seedlings. Others gave percentages going down invariably in proportion to the area. (See table I.) Referring to the percentages of large seedlings in A, B, C, and D, it may be seen that by decreasing the area by ten square meters the percentages of large seedlings will decrease on the average of 7.5 per cent. Theoretically, it would seem that by increasing the area to 240 square meters we should get approximately 100 per cent large seedlings. But the presence of a number of inferior seeds in any seed samples will naturally make the percentage less.

Referring to the results recently obtained it may be stated that the maximum number of vigorous seedlings will be obtained by sowing seeds having 91 to 100 per cent germination at the rate of one cavan to 325 square meters of seedbed. Hence, the table for the proper rate of seeding furnished herewith may be followed.

TABLE II.—*Proper rate of seedling*

Germination	Area in square meters for—		
	1 cavan	1 ganta	1 kilogram
75 to 80.....	225	9	5
81 to 90.....	275	11	7
91 to 100.....	325	13	8

The seeds should first be tested for their germination, and those of less than 75 per cent discarded if possible.

Stand.—The original number of each type of seedling was as stated above, two thousand. It is interesting to note that with two varieties used, the small seedlings were less resistant to existing conditions than the large type. The average stand for the large was 87.13 and only 59.65 per cent for the small.

TABLE III.—*Number of plants harvested and percentages of stand of different types of seedlings*

Varieties	Number harvested		Percentages stand	
	Large	Small	Large	Small
Ramai.....	1,794	1,313	88.6	64.4
Tadung.....	1,766	1,157	85.7	54.9
Averages.....	1,780	1,235	87.13	59.65

Length of culm.—The length of culm was not practically affected by the size of the transplanted seedlings. This is very

well illustrated by the results obtained from the variety Tadung in which the model type was 100 centimeters and the average or mean length was 91 centimeters of both large and small types of seedlings. The results from Ramai do not seem to agree for the model types were 115 and 105 and the average lengths were 111.2 and 102.9 centimeters for large and small, respectively. The difference of nodes was 10 centimeters and the means 8.3 centimeters in favor of the large seedlings. For other details, see Table IV.

Number of culms per plant.—Large seedlings produced bigger stools or a greater number of culms to the plant. (Observe Table V.) The difference between large and small seedlings is obvious in their nodes and averages. Ramai having 5 and 3 for model types in the number of culms, gave the averages 5.01 and 3.47 culms per plant. Tadung, the nodes of which were 4 and 3, gave the averages 5.05 and 3.73 culms to the plant.

Weight of grain.—The large type of seedlings gave higher average yields of grain per plant, and greater production per hectare than the small seedlings. (Note tables VI and VII.) Ramai gave 14.4 grams average yield per plant of the large type as against 9.11 grams of the other kind while the nodes were 12 and 8 grams, respectively. Tadung with 8 and 6 grams as model types gave the average yields, 13.05 grams and 8.23 grams for large and small, respectively. Comparing the total production of one type of seedlings with the other, the small type produced only 46 per cent of the large type for the variety Ramai and 44 per cent correspondingly for Tadung. Therefore, the average of the total production of small seedlings of the two varieties was 45 per cent of the average of the total production of large type of seedlings of these varieties.

Now considering the influence of the rate of seeding upon the yields and basing upon results obtained from Ramai on tables I and VII, evidently the yields per hectare are invariably decreasing in inverse ratio to the area of the seed-beds for a given quantity of seeds. In other words, thick seeding tends to produce weak seedlings, hence small crops. (See table VIII.) The rate, one cavan seed to 200 square meters which produced 81 per cent large seedlings and 19 per cent small ones, will give a yield of 2,569 kilograms to the hectare, whereas the third rate having 140 square meters for one cavan of seed will only produce 1,904 kilograms of rough rice per hectare. Thus, the yield is decreased by 25.8 per cent or 6.65 kilograms by the use of the latter.

SUMMARY OF CONCLUSIONS

The results obtained so far show conclusively that the rate of seeding directly influences the size of seedlings for transplanting, hence, also the yields. Moreover, large seedlings make a better stand in the proportion of 87.13 per cent to 59.65 per cent. The small seedlings produced less culms and of less average weight of grain per plant. In addition to this, the total production of small seedlings was only 45 per cent of what the larger yielded. On the other hand, the length of culm was only slightly affected, if at all, by the size of the transplanted seedlings.

TABLE IV.—Frequency distribution for the height of plants

Height (cm.)	Ramai		Tadung	
	Large	Small	Large	Small
50.....	0	0	0	1
51.....	0	0	0	0
52.....	0	0	0	0
53.....	0	0	0	0
54.....	0	0	0	1
55.....	0	0	1	0
56.....	0	0	0	0
57.....	0	0	0	1
58.....	0	0	0	0
59.....	0	0	0	1
60.....	0	3	1	4
61.....	0	0	1	2
62.....	0	1	1	1
63.....	0	0	1	5
64.....	0	1	1	3
65.....	0	2	4	6
66.....	1	0	2	5
67.....	0	1	3	8
68.....	0	2	1	3
69.....	1	1	1	2
70.....	1	4	8	9
71.....	0	3	4	10
72.....	2	5	3	4
73.....	0	3	7	6
74.....	1	4	5	11
75.....	2	5	16	11
76.....	1	8	14	14
77.....	1	7	14	14
78.....	3	10	5	15
79.....	2	5	6	13
80.....	7	15	36	30
81.....	2	7	18	14
82.....	6	11	26	15
83.....	2	14	24	25
84.....	3	19	31	30
85.....	9	20	46	45
86.....	10	14	33	35
87.....	9	25	36	53
88.....	13	12	30	39
89.....	12	18	26	22
90.....	21	31	71	51
91.....	20	17	78	42
92.....	19	32	49	37
93.....	17	21	55	41
94.....	28	30	79	52
95.....	25	38	71	49
96.....	32	25	49	43
97.....	28	28	48	25
98.....	37	31	52	33
99.....	21	23	55	37
100.....	50	51	131	64
101.....	36	38	48	26
102.....	39	34	47	17
103.....	32	33	37	24
104.....	60	33	56	19

TABLE IV.—*Frequency distribution for the height of plants—Continued*

Height (cm.)	Ramai		Tadung	
	Large	Small	Large	Small
105.....	52	59	65	20
106.....	47	26	37	9
107.....	42	38	40	12
108.....	45	29	28	11
109.....	52	22	15	8
110.....	67	56	46	21
111.....	46	32	25	13
112.....	51	33	18	6
113.....	40	32	13	7
114.....	45	23	21	3
115.....	73	35	23	10
116.....	49	24	12	5
117.....	47	27	12	2
118.....	59	20	11	2
119.....	51	12	6	5
120.....	71	30	7	7
121.....	40	19	5	1
122.....	36	14	8	1
123.....	35	13	3	1
124.....	38	11	4	1
125.....	37	15	2	0
126.....	23	13	4	1
127.....	24	11	3	0
128.....	26	5	2	1
129.....	24	6	2	1
130.....	32	7	1	1
131.....	13	3	3	0
132.....	12	0	0	0
133.....	9	2	1	0
134.....	10	2	2	0
135.....	10	0	2	0
136.....	3	0	1	0
137.....	7	0	0	0
138.....	5	2	0	0
139.....	4	0	0	0
140.....	7	1	2	0
141.....	2	1	0	0
142.....	2	0	1	0
143.....	2	0	0	0
144.....	0	0	0	0
145.....	2	0	0	0
Totals.....	1,794	1,313	1,766	1,157
Averages.....	111.2	102.9	91.01	91.08

TABLE V.—*Frequency distribution for the number of culms*

Number of culms	Ramai		Tadung	
	Large	Small	Large	Small
1.....	19	63	48	65
2.....	114	278	116	210
3.....	257	397	234	289
4.....	375	272	344	281
5.....	382	163	343	139
6.....	297	82	293	102
7.....	168	28	172	42
8.....	93	21	126	20
9.....	54	5	48	5
10.....	19	1	26	3
11.....	9	2	9	0
12.....	2	1	2	1
13.....	3	0	2	0
14.....	0	0	2	0
15.....	1	0	0	0
16.....	1	0	1	0
Totals.....	1,794	1,313	1,766	1,157
Averages.....	5.01	3.47	5.05	3.73

TABLE VI.—Frequency distribution for the weight of grain produced per plant

Weight of grains (grams)	Ramai		Tadung	
	Large	Small	Large	Small
1.....	3	21	11	29
2.....	14	45	29	58
3.....	16	63	46	68
4.....	37	107	67	119
5.....	42	90	54	79
6.....	93	140	93	123
7.....	63	65	59	74
8.....	116	142	139	111
9.....	87	107	108	75
10.....	94	85	134	70
11.....	108	82	67	38
12.....	121	75	128	71
13.....	120	48	74	36
14.....	80	44	91	33
15.....	100	33	97	28
16.....	91	32	86	21
17.....	60	20	41	13
18.....	87	24	86	15
19.....	65	13	43	6
20.....	60	10	46	12
21.....	57	9	38	7
22.....	38	4	18	0
23.....	40	4	30	1
24.....	27	4	31	5
25.....	26	5	14	0
26.....	20	2	20	0
27.....	12	5	15	1
28.....	23	3	13	3
29.....	12	1	6	1
30.....	11	1	4	0
31.....	8	1	6	1
32.....	8	2	6	0
33.....	6	0	2	0
34.....	4	0	2	0
35.....	5	0	2	1
36.....	8	0	3	0
37.....	0	0	1	0
38.....	2	0	0	0
39.....	0	0	0	0
40.....	0	0	0	0
41.....	1	0	1	0
42.....	0	0	1	0
43.....	1	0	0	0
44.....	0	0	0	0
45.....	0	0	0	0
46.....	0	0	0	0
47.....	1	0	0	0
48.....	0	0	0	0
49.....	1	0	0	0
50.....	0	0	0	0
51.....	2	0	0	0
52.....	0	0	0	0
53.....	0	0	1	0
Totals.....	1,770	1,287	1,713	1,099
Averages.....	14.4	9.11	13.05	8.23

TABLE VII.—Comparative yields of large and small sized seedlings

Varieties	Actual yields in kilograms		Yields per hectare in kilograms	
	Large	Small	Large	Small
Ramai.....	25.488	11.705	3,186	1,463
Tadung.....	22.354	9.036	2,794	1,130

TABLE VIII.—*Theoretical yields as influenced by the rate of seedlings, based from Ramai*

Rate of seeding 1 cavan (sq. meters)	Percentages		Yields per hectare in kilograms	Decrease yields in kilograms
	Large	Small		
200.	81	19	2,569
170.	60	40	2,497	72
140.	32	68	1,904	593
120.	21	79	1,715	189
60.	15	85	1,584	131

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THE EFFECT OF SUNLIGHT ON THE GERMINATION OF PAPAYA SEEDS, *CARICA PAPAYA*

By EMILIO K. MORADA, *Assistant in Horticulture*

It is a well-known fact that sunlight plays an important rôle in the germination of seeds. How much sunlight is required to give a satisfactory result for an individual variety of seeds is the chief aim of this experiment. The absence of sunlight will either hinder or destroy more or less the germinative power of the seed, because it deprives the seed of the stimulant which hastens its germination. The quantity of light necessary for the germination of seeds depends on the intensity of the sunlight, the size and the characteristics of the covering of the seeds in question. The smaller the seeds the less light is needed. The harder and the thicker the covering is, the more light is required.

To germinate the papaya seeds successfully a proper amount of light is required. Many people fail to germinate papaya seeds because they do not provide the necessary amount of light required for the best germination. They often place them either under total shade or sunlight and as a result the seeds will give a low germination or none at all. In the first case, the seeds will be dormant for a long time; while in the second case the germinating power is lost due to the excessive amount of sunlight. Therefore, in order to avoid the many failures in germinating papaya seeds, this experiment on the relation of sunlight on its germination was conducted at the Lamac Experiment Station, Lamac, Bataan.

PLAN OF THE EXPERIMENT

A good sized ripe fruit of Hawaiian papaya was obtained. The seeds were taken and washed thoroughly by removing the outer covering and the watery substance adhering to the seeds. Then they were dried at room temperature for a day. The seeds were then divided equally into five portions of 300 seeds each. The seeds in each portion were planted in separate earthen pots of about 22.5 cms. in diameter, filled with soil, leaving only about 3 cms. unfilled. The seeds were broadcasted on the

surface and covered with a thin layer of soil. Each pot was subjected to the following conditions:

- 1. Entire shade,—the whole day without receiving heat of the sun.
- 2. Entire shade,—the pot was placed in the shade near the edge of the building the whole day so that it received more light than No. 1.
- 3. Half day sunshine from 7 a. m. to 11.30 a. m.
- 4. Partial shade,—under the nursery shed.
- 5. Entirely exposed in the sunlight the whole day.

The pots under all the conditions received the same treatment as to watering, mixture of soils, drainage, etc.

The dates and per cent of germination were recorded.

After a month the pots under the first and second conditions were placed under the third condition to determine whether the seeds which did not germinate would still grow.

A second set of similar experiment has been undertaken to verify the first results.

Tables I and II indicate the results of the experiment.

TABLE I

Conditions	Date		Number of seeds germinated	Percentage of germination	Remarks
	Planted	Germinated			
1.....	April 5...	0	0	Subjected to condition 3 on May 17. Fifteen seeds germinated on May 23,—5 per cent.
2.....	April 5...	April 19..	44	14.66	
3.....	April 5...	April 15..	107	35.66	
4.....	April 5...	April 15..	63	21.0	
5.....	April 5...	.....	0	0

TABLE II

Conditions	Date		Number of seeds germinated	Percentage of germination	Remarks
	Planted	Germinated			
1.....	May 17..	June 28..	3	1.00	Subjected to condition 3 on July 2. Twenty-five seeds germinated on July 10,—8.33 per cent. Subjected to condition 3 on July 2. Thirty-two seeds germinated on July 8,—10.66 per cent.
2.....	May 17..	June 28..	8	2.66	
3.....	May 17..	May 28..	80	26.66	
4.....	May 17..	May 28..	41	13.66	
5.....	May 17..	.....	0	0

DISCUSSION OF RESULT

It will be noticed in table I that the seeds germinated under conditions 2, 3, and 4, while the seeds did not germinate under conditions 1 and 5. Under condition 3 the highest percentage of germination was obtained, which is 35.66 per cent; under condition 4, is 31.0 per cent; and under condition 2, 14.66 per

cent. The seeds under condition 5 did not germinate because of the excessive sunlight which destroyed the vitality of the seeds. No germination was obtained under condition No. 1 but in subjecting the seeds to condition 3, 5 per cent germination was obtained. This shows that the seeds are dormant in a shady place, and no germination could be obtained unless a certain amount of sunlight was given them. It takes also longer time for the seeds under condition 2 to germinate than those under conditions 3 and 4.

In the experiment shown in Table II, the same results have been obtained, comparatively speaking. Under condition 3, 26.66 per cent germination was obtained, the highest percentage of germination; under condition 4, 13.66 per cent; under condition 2, 2.66 per cent; and under condition 1, 1.0 per cent. The seeds under condition 5 did not germinate. In subjecting those under conditions 1 and 2 to condition 3, they gave a germination of 8.33 per cent and 10.66 per cent, respectively. The seeds under conditions 3 and 4 germinated in 11 days while those under conditions 1 and 2 previous to other treatments germinated in 42 days. On putting under condition 3, the seeds under condition 2 germinated in 6 days while those under condition 1 germinated in 8 days. In all cases, there was a low percentage of germination.

From the above results, it is therefore self-evident that a certain amount of sunlight is necessary in the germination of papaya seeds, and that its absence retards the germination of the seeds, and may destroy the germinative power of same also. Too much sunlight as under condition 5 destroys the vitality of the seeds while too little sunlight retards the germination. One-half day sunshine from 7 a. m. to 11.30 a. m. and one-half sunshine under partial shade is the amount of sunlight necessary for the germination of papaya seeds.

CONCLUSION

1. Seeds under total shade during the whole day will not germinate but on exposing to sunlight for one-half day, they will.

2. One-half day sunshine from 7 a. m. to 11.30 a. m. and partial shade (under nursery shed) are the best condition under which seed germinate.

3. Too much sunlight is detrimental to the seeds. It destroys the vitality of the seeds. On the other hand, the absence of sunlight will retard the germination. The seeds will be in a dormant stage.

THE SEEDLESS BREADFRUITS OF THE PACIFIC ARCHIPELAGOES

By P. J. WESTER

INTRODUCTION

"In the reign of a certain king when the people ate *araea*, red earth, a husband and wife had an only son whom they tenderly loved. The youth was weak and delicate, and one day the husband said to the wife: I compassionate our son, he is unable to eat the red earth. I will die and become food for him. The wife said: How will you become food? He answered: I will pray to my god, he has power and he will enable me to do it. Accordingly he repaired to the family *marae* and presented his petition to the deity. A favorable answer was given to his prayer, and in the evening he called his wife to him and said: I am about to die; when I am dead take my body, separate it, plant my head in one place, my heart and stomach in another, etc., and then go into the house and wait. When you shall hear first a sound like that of a leaf, then of a flower, afterwards of an unripe fruit, and subsequently of ripe, round fruit falling to the ground, know that it is I who am become food for our son. He died soon after. His wife obeyed his injunction, planting the stomach near the house as directed. After a while she heard a leaf fall, then the large scales of the flower, then a small unripe fruit, afterwards one fullgrown and ripe. By then it was daylight. She awoke her son, took him out, and they beheld a large, handsome tree with broad, shining leaves and loaded with breadfruit."

According to tradition in Tahiti this is the origin of the breadfruit.

While the breadfruit (always speaking of the seedless form) probably originated in some of the islands east of Java, and thence was carried eastward by the Polynesians in their early migrations, it was first seen in the Marquesas Islands in 1595 by Europeans. Quiros gave the earliest account of the breadfruit in a letter to Morga, published in 1609, where he says that "there is no fruit superior to it." Rumphius, the first

writer to mention it from the Malay Archipelago, says that it was unknown in the western part and found only in the east and southeast (of the Dutch East Indies). Even yet the breadfruit is of but little importance in that country, and Heyne records only two varieties (in Madura).

Since Morga, who was made acquainted with the breadfruit from the Marquesas by Quiros, does not mention it from the Philippines in his "Sucesos," it may be assumed that it was still unknown here at the beginning of the seventeenth century. As the *Dugdug Marianorum* is obviously a species from Guam included by Camello in his descriptions of Philippine fruits published in Ray's "Historia Plantarum," so there is nothing to indicate that his description of *Rhymay Marianorum* is not also that of a species from Guam, at best recently thence introduced in the Philippines, where it is now known as *Rima* in Luzon. In Guam as *Lemae*. Blanco's statement that the seedless breadfruit occurs spontaneously in Leyte may safely be discounted. Moro tradition has it that the Marang, *Artocarpus odoratissima*, mango, durian, and mangosteen were introduced by them from the west, but the breadfruit was unknown to the Moros until a few years ago when it was brought from Manila to Jolo and Zamboanga.

The famous Captain Cook on his return to England said about the breadfruit: "Of the many vegetables that have been mentioned already as serving them (the Tahitians) for food the principal is the breadfruit, to procure which costs them no more trouble or labor but climbing a tree. The tree which produces it does not indeed shoot up spontaneously, but if a man plants ten of them in his lifetime, which he may do in an hour, he will as completely fulfill his duty to his own and future generations as the natives of our less temperate climate can do by plowing in the cold of the winter and reaping in the summer heat as often as these seasons return; even if, after he has procured bread for his present household, he should convert a surplus into money and lay it up for his children."

It was glowing accounts like these which finally persuaded the British Government to dispatch the illfated ship *Bounty*, in command of Captain Bligh, to Tahiti, for a shipload of breadfruit trees for introduction into the British colonies in the West Indies.

The Swedish botanist Solander, who accompanied Captain Cook, made the first variety list of the seedless breadfruits. His list, which has never been published, enumerated some twenty

kinds from Tahiti. He called the breadfruit "the most useful vegetable in the world."

Curiously enough, notwithstanding the interest in the breadfruit, nearly a century passed before the first comprehensive account about it appeared. This by Seemann from Fiji, where the author recognized thirteen varieties, all seedless except one.

Prefacing his description of the breadfruit Seemann says:

"The breadfruit is seen in regular forests, and in a great number of varieties, which the newcomer has some difficulty in distinguishing until he has learned to observe that in the shape of the leaves—which are either entire, pinnatisect or bi-pinnatisect—their size and their either bullate or even surface, the shape and size of the fruits, the time of its maturity, the absence or presence, as well as the length of the prickles on its outside, and the abortion of its ovules or their development into seed, offer good marks of distinction. The general Fijian name for the breadfruit is Uto, signifying "the heart," from the resemblance of the fruit to that organ, while the varieties are distinguished by additional names. Those less frequently cultivated are, however, not known by the same names throughout the group, but bear different ones in the different districts. Hence the exact number of varieties cannot be accurately determined until there shall be a botanic garden in Fiji where a complete collection of breadfruits is cultivated. The principal breadfruit season is in March and April, but some kinds ripen considerably earlier or later, while in some districts the season itself is altogether later. It may thus be said, speaking generally, that there is ripe breadfruit, more or less abundant throughout the year in either one part or the other of the Fiji Islands. The fruit is made into puddings or simply boiled or baked. Quantities of it are preserved underground to make *madrai*, or native bread. Some kinds are best adapted for pudding, some for bread, or culinary purposes of a still more simple description."

Wilkes, of the United States Exploring Expedition, 1844, stated that there were twenty different sorts of breadfruit in Samoa, and nine varieties in the Tonga Islands, but their names have never appeared in print so far as the writer is aware.

In "Gatherings of a Naturalist," 1860, Bennett published an annotated list of twenty-four kinds of breadfruits in Tahiti. In "Eastern Pacific Islands," 1910, Christian enumerates thirty-four varieties in the Marquesas, where according to Ellis in "Polynesian Researches" the breadfruit attains greater per-

fection than anywhere else. Christian also published an annotated list of fifty three breadfruit varieties in the Carolines in "The Caroline Islands," 1899.

In reply to an inquiry about the breadfruits of the Society and the Marquesas Islands Mr. Howard F. Withey, American Consul in Tahiti, under date of April 11, 1922, mailed the writer annotated lists of the breadfruit varieties, including 52 kinds from the island of Tahiti and 25 sorts from the Marquesas. In forwarding these lists Mr. Withey remarks that: "The following report is based upon notes furnished by Dr. Forest B. H. Brown of the Bishop Museum of Honolulu, who has spent over a year and a half investigating the flora of this consular district. For the most part the report is a mere transcription of such notes. Not all the varieties in the Marquesas have been listed but those included have apparently been most thoroughly investigated. Apparently the Marquesas have originated some 25 varieties, and there are at least 50 varieties in the Island of Tahiti in the Society Islands. With one exception all the varieties are seedless. It is believed that by planting judiciously selected varieties a continuous yield of fruit can be obtained. No other fruit in these regions equals the breadfruit in yield. In both the Society Islands and the Marquesas the breadfruit seems to be practically free from diseases and insects pests. As a food there seems to be but one criticism of the breadfruit, i. e., that it does not keep well."

Articles about the breadfruit have previously been published by the writer with a view to attracting interest in this unique fruit. The following list of the breadfruit varieties grown in the Pacific Archipelagoes has been compiled to make conveniently available the scattered information about this subject, to show the remarkable number of forms that have been evolved, also to show how incomplete is our knowledge of them. All the varieties in the following list are seedless unless otherwise indicated. A large number of names are undoubtedly synonyms.

ENUMERATION AND DESCRIPTION

Aano.—The fruit is small, globose, somewhat rough, yellowish green, the facets very slightly conical, elevated. The stem is rather long, 75 mm.; the core small, elongated.¹

PAPEETE, TAHITI.

Abuabu.—Undescribed.²

¹ Adapted from notes furnished by Mr. Howard F. Withey, American Consul in Tahiti.

² Included in a list of breadfruit varieties growing in Tahiti and the Marquesas furnished by Mr. Withey.

TAHITI.

Aeka.—The fruit is nearly globose, inequilateral, smooth with convex facets; the flesh of "loose" texture. The stem is very short; 2 to 3 cm. long, hairy; the core relatively large, 8 cm. long.¹

NUKAHIVA, MARQUESAS.

Afara.—The fruit is large, 15 cm. in diameter, spherical, smooth; color very distinctive, brownish red. The stem is slender and slightly hairy. Of excellent quality. Rare.¹

PAPEETE, TAHITI.

Afatu.—The fruit is small and round.³

TAHITI.

Anuani.—Undescribed.⁴

TAHITI.

Aoa.—Undescribed.²

TAHITI.

Apil.—The fruit is small and round.⁵

PONAPI, CAROLINES.

Atara.—Undescribed.²

TAHITI.

Aravei.—The fruit is large, and variable in shape, from spherical to oblong.¹

PAPEETE, TAHITI.

Auena.—Undescribed.⁶

MARQUESAS.

Aukohi.—The fruit is good, and is quickly roasted.¹

NUKAHIVA, MARQUESAS.

Aumure.—The fruit is large, 20 cm. across, slightly longer than broad, smooth, with small facets. The stem is short, 5 cm. long.¹

PAPEETE, TAHITI.

Autea.—Undescribed.⁶

MARQUESAS.

Autia.—The fruit is large, spherical, slightly tuberculate, greenish yellow; core rather large, elongated, edible.¹

PAPEETE, TAHITI.

Avei.—The fruit has a rough surface.¹

TAHITI.

Aveu.—The fruit is large, spherical to broadly ellipsoidal, nearly smooth, the facets coarse and slightly elevated. The stem is 75 mm. long.¹

¹ Adapted from Bennett, G., *Gatherings of a Naturalist*, 1860.

⁴ Bennett, G., *Gatherings of a Naturalist*, 1860.

⁵ Adapted from Christian, F. W., *The Caroline Islands*, 1899.

⁶ Christian, F. W., *Eastern Pacific lands*, 1910.

PAPEETE, TAHITI.

Balekana.—The leaves are pinnatisect, with an even surface. The fruit is small, but of superior quality.⁷

SOMO-SOMO, AND OVALAU, FIJI.

Bokasi.—The leaves are pinnatisect, with an even surface. The fruit is obovate, and smooth. The stem is at first erect, but nodding at maturity of the fruit. An early ripening variety.⁷

FIJI.

Buero.—Undescribed.⁴

TAHITI.

Buko.—The leaves are pinnatisect, with an even surface. The fruit is large, short-ovate, and smooth.⁷

FIJI.

Chai.—The fruit is smooth.⁵

PONAPI, CAROLINES.

Chaniak.—The fruit is small.⁵

PONAPI, CAROLINES.

Dina.—The leaves are pinnatisect with an even surface. The fruit is nearly spherical and smooth. The stem is 10 to 12.5 cm. lang, and nodding throughout the whole period of growth.⁷

FIJI.

En-chak.—The fruit is oblong.⁵

PONAPI, CAROLINES.

En-charak.—The fruit is spiny.⁵

PONAPI, CAROLINES.

En-cherrichang.—The fruit is small, reddish and spiny.⁵

PONAPI, CAROLINES.

En-kaualik.—The fruit is long, with a rough surface.⁵

PONAPI, CAROLINES.

En-kotokot.—The fruit is small and spiny.⁵

PONAPI, CAROLINES.

En-machal.—The fruit is oblong.⁵

PONAPI, CAROLINES.

En-monei.—The fruit is long, slender and spiny.⁵

PONAPI, CAROLINES.

En-paipai.—The fruit is oblong and spiny.⁵

PONAPI, CAROLINES.

En-pakot.—The fruit is long, with a rough surface.⁵

PONAPI, CAROLINES.

En-par.—The fruit is oblong, with a dark, spiny surface.⁵

⁷ Adapted from Seemann, B. C., Viti, 1862.

PONAPI, CAROLINES.

En-patak.—The fruit is oblong, reddish and spiny.⁵

PONAPI, CAROLINES.

En-pon-chakar.—The fruit is reddish and spiny.⁵

PONAPI, CAROLINES.

En-po-le.—The fruit is oblong.⁵

PONAPI, CAROLINES.

En-put.—A small, round fruit with a rough surface.⁵

PONAPI, CAROLINES.

En-uaoutak.—The fruit is small.⁵

PONAPI, CAROLINES.

En-ucher.—The fruit is long.⁵

PONAPI, CAROLINES.

Faara.—Undescribed.⁴

TAHITI.

Fafaua.—The fruit is large, 13 cm. across, inequilateral, smooth. The stem is long. A good variety.¹

HIVAOA, MARQUESAS.

Fanum.—Undescribed.⁸

YAP, CAROLINES.

Haparu.—The fruit is large, 20 cm. in diameter, globose, smooth, slightly depressed at base; facets coarse, rather irregular. Of very good quality; cooks quickly.¹

PAPEETE, TAHITI.

Haupahu.—The fruit is broadly obovoid, 9 by 13 cm., smooth; the facets almost flat, flesh of loose texture around the core. The stem is short, 3 cm. long.¹

NUKAHIVA, MARQUESAS.

Hetutu.—Undescribed.⁶

MARQUESAS.

Hinu.—Undescribed.⁶

MARQUESAS.

Hoi.—Undescribed.⁶

MARQUESAS.

Huero.—The fruit is spherical, nearly smooth, and contains occasional large seeds. Rare.¹

PAPEETE, TAHITI.

Impak.—The fruit is large and round.⁵

PONAPI, CAROLINES.

⁸ Christian, F. W., The Caroline Islands, 1899.

Iofai.—Undescribed.⁴

TAHITI.

Kakanokoe.—Undescribed.⁶

MARQUESAS.

Kalak.—The fruit is small and smooth.⁶

PONAPI, CAROLINES.

Kalasi.—The leaves are bipinnatifid. The fruit is oblong and spiny.⁷
FIJI.

Katiu.—The fruit is long.⁵

PONAPI, CAROLINES.

Kiekie koui.—The fruit is large, 15 by 11 cm., broadly ellipsoidal, with a groove around the stem; the flesh loose around the core which is large.¹

HAKAUI, NUKAHIVA, MARQUESAS.

Kio.—The leaves are pinnatisect. The fruit is almost as large as that of the *Buko*. The surface of the fruit resembles the surface of a shark.⁷

OVALAU, FIJI.

Koka.—Undescribed.⁶

MARQUESAS.

Kokipo.—Seedless; cooks quickly.¹

NUKAHIVA, MARQUESAS.

Koko.—The leaves are pinnatisect and bullate. The fruit is smooth and of the size of the *Dina*.⁷

FIJI.

Konini.—The fruit is slightly longer than broad, smooth, with facets nearly flat; the flesh of coarse texture near the core. The stem is long, and the core large.¹

NUKAHIVA, MARQUESAS.

Koopupu.—The fruit is spherical, smooth, the facets large and flat. The stem is long and the core small.¹

NUKAHIVA, MARQUESAS.

Koufau.—Undescribed.⁶

MARQUESAS.

Kuahe.—The fruit is inequilateral; the stem very short, 1 cm. only.¹

NUKAHIVA, MARQUESAS.

Kuanui.—The fruit is medium large, and closely cupped around the stem; the facets are medium large, flat, the flesh firm. The stem is long, and the core small.¹

NUKAHIVA, MARQUESAS.

Kumar.—The fruit is long.⁵

PONAPI, CAROLINES.

Kuukou.—Undescribed.⁶

MARQUESAS.

Kuuvahane.—The flesh of this fruit is white, and of excellent quality.¹

HUAHUNA, MARQUESAS.

Letam.—The fruit is small and round.⁵

PONAPI, CAROLINES.

Lipet.—The fruit is large and spiny.⁵

PONAPI, CAROLINES.

Lolo.—The leaves are entire or obscurely lobed in the young plant, changing to entire as the tree grows older. The above is the name of this variety in the Straits of Somo-Somo. In the Rewa district it is called Kokokoko. Possibly identical with Dogodogo and Draukoko.⁷

FIJI.

Luathar.—Undescribed.⁸

YAP, CAROLINES.

Lukual.—The fruit has very long spines.⁵

PONAPI, CAROLINES.

Mahani.—The fruit is large, 20 cm. in diameter, spherical to slightly longer than broad, smooth, the facets nearly even. The stem is from 65 to 75 cm. long.¹

PAPEETE, TAHITI.

Mai-nior.—Undescribed.⁸

YAP, CAROLINES.

Maie.—Undescribed.⁹

MARQUESAS.

Maire.—The leaves are more cleft than the other varieties. The fruit is large, round and rather smooth. One of the best sorts.³

TAHITI.

Maire.—The fruit is small, 125 mm. in diameter, spherical, nearly smooth, yellowish or brownish green. The stem is 75 mm. long, hairy. Of excellent quality. Cooks quickly. The tree is common, and very ornamental and prolific.¹

PAPEETE, TAHITI.

Mamaitavaka.—The fruit is very small, maximum diameter 14 cm., roundish. The stem is about 4 cm. long, and rather hairy; the core relatively large. The fruit bakes in hot ashes within 10 minutes, is cooked in water in 10 minutes; and tastes more like a potato than any other variety. The tree is quite drought resistant.¹

HUAHUNA, MARQUESAS.

Maohi.—The fruit is of medium size, spherical or slightly longer than broad, nearly smooth. Cooks slowly and must be baked in a native oven. "Native breadfruit." In general cultivation.¹

PAPEETE, TAHITI.

Maoi.—Undescribed.²

MARQUESAS.

Maore.—Undescribed.²

TAHITI.

Mapua.—Undescribed.⁶

MARQUESAS.

Mohomoho.—Undescribed.⁶

MARQUESAS

Momi.—The fruit is very large, sub-spherical, tuberculate; the core small and elongate.¹

PAPEETE, TAHITI.

Movai.—Undescribed.⁶

MARQUESAS.

Nakont.—The fruit is small and round.⁵

PONAPI, CAROLINES.

Nan-umal.—The fruit is oblong and spiny.⁵

PONAPI, CAROLINES.

Niue.—The fruit is long.⁵

PONAPI, CAROLINES.

Nue.—The fruit is large, round and smooth. The most esteemed variety.⁵

PONAPI, CAROLINES.

Oa.—The fruit is small, spherical or slightly longer than broad, tuberculate. The stem is 75 mm. long.¹

PAPEETE, TAHITI.

Ofatia.—Undescribed.⁴

TAHITI.

Ohinuhinu.—Undescribed.²

TAHITI.

Onape.—Undescribed.⁶

MARQUESAS.

Opiha.—Undescribed.⁴

TAHITI.

Opiripiri.—Undescribed.²

TAHITI.

Orihu.—Undescribed.⁶

MARQUESAS.

Otai.—Undescribed.⁶

MARQUESAS.

Otea.—Undescribed.²

TAHITI.

Ovai.—The fruit is very large, and of excellent quality.¹

FATUHIVA, MARQUESAS.

Oviri.—Undescribed.⁴

TAHITI.

Paea.—The fruit is large, 20 cm. in diameter, broadly ellipsoidal, rough, with pointed projections; stem 10 cm. long and glabrous. The cooked flesh is very sticky.¹

PAPEETE, TAHITI.

Pafai.—Undescribed.⁴

TAHITI.

Pafara.—The fruit is small and round.⁴

TAHITI.

Paifée.—Undescribed.²

TAHITI.

Paimach.—The fruit is small.⁵

PONAPI, CAROLINES.

Panafara.—Undescribed.²

TAHITI.

Paparu.—Undescribed.²

TAHITI.

Patara.—The fruit is very large, 25 cm. in diameter, elliptical-oblong, rough with pointed projections, 6 mm. long, core four times as long as broad. Cooks quickly, and roasts well in the open fire.¹

PAPEETE, TAHITI.

Patea.—Undescribed.²

TAHITI.

Patuki.—The fruit is large, 20 by 14 cm., nearly smooth; the facets slightly concave.¹

NUKAHIVA, MARQUESAS.

Pavai.—Very large. One fruit is said to be so large as to provide food for ten men.¹

FATUHIVA, MARQUESAS.

Peau.—Undescribed.⁸

YAP, CAROLINES.

Peetautia.—The fruit is large, 15 cm. in diameter, sub-globose. Rare.¹

PAPEETE, TAHITI.

Pehi.—Undescribed.⁴

TAHITI.

Peiahuri.—A large, otherwise undescribed fruit.⁴

TAHITI.

Pemathau.—Undescribed.⁸

YAP, CAROLINES.

Pepeti.—The fruit is small, spherical, and smooth; the flesh of inferior quality and requires a long time for cooking. The stem is long and the core small.¹

NUKAHIVA, MARQUESAS.

Peti.—The fruit is large, sub-globose, depressed at base and flattened at apex, greenish yellow, smooth; the facets slightly concave, with a dark dot in the center. The stem is 5 to 7.5 cm. long, hairy; core small and globose. Of excellent quality.¹

PAPEETE, TAHITI.

Piia.—Undescribed.²

TAHITI.

Pippiia.—A large, otherwise undescribed fruit.⁴

TAHITI.

Pimata.—Undescribed. Said to be very rare. Only one tree is known.¹

FATUHIVA, MARQUESAS.

Piohe.—Undescribed.⁶

MARQUESAS.

Pipi.—Undescribed.⁶

MARQUESAS.

Pitaeatae.—Undescribed.⁶

MARQUESAS.

Piti.—Undescribed.⁶

MARQUESAS.

Poero.—The fruit is large, 15 cm. in diameter, globose, very rough; the projections conical, 4 mm. long. The stem is 10 cm. long, hairy; the core small and oblong. Of excellent quality. Bakes quickly in the open fire.¹

PAPEETE, TAHITI.

Pohauta.—The fruit is round, smooth and of excellent quality. The stem is long and stout. Cooks quickly.¹

HUAHUNA, MARQUESAS.

Pon-panui.—The fruit is long, with a rough surface.⁵

PONAPI, CAROLINES.

Porohiti.—The fruit is small and rough.¹

PAPEETE, TAHITI.

Poru.—The fruit is large, 20 cm. in diameter, globose, smooth. The stem is 75 mm. long, and hairy.¹

PAPEETE, TAHITI.

Potopot.—The fruit is oblong, light colored and spiny.⁵

PONAPI, CAROLINES.

Pu or Pupia.—Undescribed.²

TAHITI.

Puaa.—The fruit grows several in a cluster, and is spherical and smooth. The stem is about 62 mm. long, and hairy, the core is small.¹

PAPEETE, TAHITI.

(Introduced from Bora-Bora, another Island in the Society group).

Puahi.—Undescribed.⁶

MARQUESAS.

Puau.—The fruit is large, 20 cm. long, obovoid, inequilateral, smooth, with small facets, the flesh white. The stem is short and the core long. Cooks slowly.¹

NUKAHIVA, MARQUESAS.

Puaue.—The fruit is large, 20 cm. in diameter, ellipsoidal and smooth.¹

PAPEETE, TAHITI.

Pufatata.—The fruit is large, broadly ellipsoidal, the facets large and conical. The stem is glabrous, and about 7.5 cm. long.¹

PAPEETE, TAHITI.

Pulang.—The fruit is large and smooth.⁵

PONAPI, CAROLINES.

Puou.—The fruit is large, weighing five kilos, smooth, the flesh yellow and of excellent quality. Cooks quickly.¹

HIWAOA, HUAHUNA, MARQUESAS.

Pupupi.—Undescribed.⁶

MARQUESAS.

Pureru.—Undescribed.²

TAHITI.

Puupuu.—Undescribed.²

TAHITI.

Puvero.—Undescribed.²

TAHITI.

Rare.—The fruit is large, 15 cm. long, ellipsoidal, smooth, with slightly elevated facets. The stem is 7.5 cm. long, hairy, the core oblong. Of excellent quality.¹

PAPEETE, TAHITI.

Raumae.—Undescribed.²

TAHITI.

Rautia.—Undescribed.⁴

TAHITI.

Rauvaravara.—Undescribed.²

TAHITI.

Rokouta.—The leaves are pinnatisect, with a bullate surface, giving the tree a diseased appearance.⁷

NAMARA, FIJI.

Roru.—Undescribed.⁴

TAHITI.

Sore.—The leaves are pinnatisect, with an even surface. The only seedy variety is Fiji. Known under the above name is Rewa; as *Vaka Sorena* in Ovalau; as *Asalea* in the Straits of Somo-Somo; as *Maliva* in Nukubalaon; all in Fiji.⁷

FIJI.

Taataa.—The fruit is very rough, and the flesh is lumpy when ripe, but of good quality.¹

HUAHUNA, MARQUESAS.

Taataatoetoe.—The fruit is inequilateral, smooth and of good quality. The stem is short and smooth, the core 10 cm. long.¹

HIWAOA, MARQUESAS.

Tafara.—Undescribed.²

TAHITI.

Tagafei.—Undescribed.³

YAP, CAROLINES.

Taik.—The fruit is large and smooth.⁵

PONAPI, CAROLINES.

Tahaka.—Undescribed.⁶

MARQUESAS.

Takai.—The fruit is round, and very hard.⁵

PONAPI, CAROLINES.

Tal.—The fruit is small, dark and spiny.⁵

PONAPI, CAROLINES.

Tao.—Undescribed.²

TAHITI.

Tapa.—Undescribed.⁶

MARQUESAS.

Tatara.—Undescribed.²

TAHITI.

Teve.—Undescribed.⁶

MARQUESAS.

Ti.—The fruit is oblong and spiny.⁵

PONAPI, CAROLINES.

Tiatea.—Undescribed.²

TAHITI.

Tioe.—Undescribed.⁶

MARQUESAS.

Toerau.—The fruit is large, spherical to ellipsoidal, and smooth.¹

PAPEETE, TAHITI.

Tohetupou.—Undescribed.²

TAHITI.

Tookaha.—The fruit is large, up to five kilos in weight, the flesh of excellent quality. The largest breadfruit in the northern group. Said not to fruit every year.¹

NUKAHIVA, HUAHUNA, MARQUESAS.

Tona.—Undescribed.⁶

MARQUESAS.

Touarau.—Undescribed.²

TAHITI.

Tuavera.—Undescribed.²

TAHITI.

Tutou.—The fruit is inequilateral, slightly longer than broad, 17 by 12 cm., the facets convex; the core short.

NUKAHIVA, MARQUESAS.

Tuutou.—The fruit is large, 20 cm. long, obovoid, nearly smooth, yellowish green to brownish; the facets small, slightly raised. The stem is short, about 25 mm. long, the core elongated. Of excellent quality.¹

PAPEETE, TAHITI.

Uaka.—The fruit is large, oblong and spiny.⁵

PONAPI, CAROLINES.

Uea.—Undescribed.⁶

MARQUESAS.

Vaeoaeota.—The fruit is seedless and of good quality.¹

NUKAHIVA, HIWAOA, MARQUESAS.

Varaka.—The leaves are pinnatisect, and larger than in any other variety in Fiji. The fruit is of medium size, with a rough surface.⁷

FIJI.

Vevee.—Undescribed.⁶

MARQUESAS.

Vonu.—The leaves are pinnatisect. The fruit is large.⁷

SOMO-SOMO, FIJI.

Votovoto.—The leaves are pinnatisect, with an even surface. The fruit is oblong, and the surface covered with spines about 8 mm. long.⁷

FIJI.

Yae-reb.—Undescribed.⁸

YAP, CAROLINES.

Yao-lei.—Undescribed.⁸

YAP, CAROLINES.

Yao-uat.—Undescribed.⁸

YAP, CAROLINES.

Yeo-tui.—Undescribed.⁸

YAP, CAROLINES.

Iao-tathen.—Undescribed.⁸

YAP, CAROLINES.

Yong.—The fruit is small.⁵

PONAPI, CAROLINES.

Yu-goi.—Undescribed.⁸

YAP, CAROLINES.

Yu-ngalu.—Undescribed.⁸

YAP, CAROLINES.

DIRECTIONS FOR SAVING AND KEEPING VEGETABLE AND OTHER SEEDS

By P. J. WESTER

GENERAL REMARKS

Good seed is a prime requisite for a good harvest of all field and garden crops. How to procure seeds of good quality in adequate quantities at a reasonable price is an annually recurring problem to many farmers in this country. Frequently many vegetables are not planted because seeds cannot be procured. On the other hand observations covering many years have shown the writer that considerable effort is wasted in saving seed that might have been put to a better purpose.

This paper has been prepared with a view to clearing away some of the misconceptions on this subject and to assist in getting a more plentiful supply of homegrown seed of good quality.

It is a well-known fact to all residents of the Islands who have tried their hand at growing vegetables that the seeds of so-called temperate vegetables, such as cabbage, rutabagas, turnips, and onions lose their viability within a few weeks, especially if they are exposed to the air, or become infested with weevils. Some of them do bear seeds but the vegetables grown therefrom are so inferior to those grown from imported seeds and the expense of gathering them is relatively so great that it does not pay to save seeds from them. It is greater all around economy to plant imported seeds.

There are numerous vegetables of tropical origin, however, which produce excellent seeds abundantly in this country at a very slight cost for gathering that it is difficult, frequently impossible, to obtain from seed dealers in foreign countries, and even when obtainable cost much more than if they had been produced at home. If properly dried and stored they keep from harvesting to planting season without marked deterioration.

PLANTS OF WHICH IT IS INADVISABLE TO SAVE SEED

The following is a list of plants of which it is inadvisable to collect seed for future planting. Imported seeds are cheaper and give better results. The ordering of these seeds should be timed so that they will arrive at their destination about when the planting season begins. They should be sown at the earliest practicable date after arrival. If they are not sown at once, they should be placed in clean air tight jars, bottles, or tin cans and stored away in a dry, cool, dark place until they are planted.

Beet	Kohlrabi	Pechay
Cantaloupe	Leek	Radish
Carrot	Lettuce	Rape
Cauliflower	Mustard	Rutabaga
Celery	Onion	Turnip
Dill	Parsley	Watermelon
Endive	Parsnip	

PLANTS OF WHICH IT IS ADVISABLE TO SAVE SEED

Seeds of good quality of several imported vegetable and field crops are produced in sufficient abundance to warrant saving them for planting for from 3 to 6 generations, but with each generation the product deteriorates and finally it again becomes necessary to reimport seed from the temperate zone. This statement applies to these crops under ordinary field practice. Systematic acclimatization and breeding work quite likely would yield varieties well adapted to Philippine conditions that could be propagated here indefinitely. The foregoing statement refers to the following plants:

Beans (bush and climbing)
 Cowpeas
 Patani (imported bush and climbing varieties)
 Peas
 Potatoes
 Sunflowers

Of these the seed of six generations of cowpeas can be saved successively, while the other plants ordinarily "run out" within from three to four generations.

The saving of seed on the farm is recommended for the following crops, enumerated under A, B, C, D, and E.

A. GRAINS AND LEGUMES

Adlay		Borona
Anipay		Corn
Batao		Guar
Beans:		Kadios
Lyon		Kambu
Marutong		Kodo
Patani (native)		Mungo
Seguidilla		Ragi
Sitao		Rice
Velvet		Sorghum
Sinkama		
Soya		

The stalks of the grains should be cut so as to leave a convenient "handle," and the heads tied in bundles and dried. In regions with a well marked wet and dry season they ripen after dry weather has begun. Here the drying is best effected in the open. In districts where the weather is uncertain during the harvest period the bundles should be hung up to dry in a shed. When thoroughly dried the grains should be threshed and cleaned, except corn, which may be left in the husk if desired.

The pods of the different legumes should be allowed to remain on the plants until they have changed color and become dry, and the seeds or beans have hardened. They should then be picked. They will still contain some excess moisture, and therefore should be placed on canvas sheets or shallow trays in the sun, and stirred now and then to insure even drying. After a few days' exposure in the sun the pods will be so dry and brittle that they can be threshed by placing them in gunny sacks and beating them with flails, after which the seeds can easily be cleaned. Then, to insure thorough drying of all seeds it is well to expose the cleaned seed in the sun, spread thin in shallow trays for a couple of days before they are stored away. They should be allowed to cool over night before being placed in storage if the receptacles used are of any considerable size.

B. PLANTS WITH PARTLY DRIED PODS

Okra	Sesame
Roselle	Talinum

The seed pods should be gathered as soon as they change color, before the seed shatters, and placed on trays to dry in the sun. If the plants are not carefully watched, much of the

seed is apt to be lost. When they are pointing downward the seed pods of the talinum are ready for gathering. When thoroughly dried treat the seeds as already recommended for the grains and legumes.

C. FLESHY VEGETABLES

These include plants the seed of which are embedded in a fleshy, more or less watery pulp from which they must be cleaned before they are dried. They include:

Apalia	Kondol	Pumpkin
Chili	Pakupis	Squash
Eggplant	Patola	Tomato
Cucumber	Pepper	Upo

The fruits should be allowed to remain on the plants until fully mature as shown by their color. They should then be opened with a knife or bolo and the seeds scraped out. More or less of the pulp, according to their kind, will adhere to the seed, and the mass should be left in a bucket for two or three days, or just long enough for the pulp to decay sufficiently so that it can be easily washed away from the seed. The seeds should then be rinsed in several waters until the last water remains clear. After which they should be placed thinly in shallow trays, put in a semi-shaded spot, and stirred from time to time until the entire lot is well dried, say two or three days. They should then be stored away as previously directed for the grains.

D. TUBERS, ETC.

Arrowroot	Kemili	Shallots
Artichoke	Nami	Tongo
Gabi	Potato	Ubi
Garlic	Sapang	Yautia
Ginger	Sembu	

These plants are not propagated from seed but from tubers or sets.

As the crops of these plants are harvested, bruising the tubers should be guarded against because this invites decay. They should be cleaned of adhering soil and spread thin in the shade to dry for a few days to allow the surplus moisture to evaporate. Finally, they should be stored away in a cool, dry, dark, rat-proof place.

E. MISCELLANEOUS CROPS

For treatment of rice, corn, peanuts, and tobacco seeds, see the bulletins and circulars issued about these crops.

Chayote.—The seeds cannot be removed from the fruits of this plant, which should be stored away in a cool, dark place until planting time.

Libato.—The fleshy covering of the seeds should be washed off in clean water, and the seeds dried in the shade before storing.

Spinach, New Zealand.—This excellent vegetable for the mountain regions produces seeds in abundance, which should be gathered when ripe, and then dried before storing.

Cassava.—Enough plants from which to procure seed canes should be left in the ground. The mature canes will keep alive several weeks if they are stored in a dark, cool place, and occasionally sprinkled with water.

Kamote.—This plant is so easily propagated from cuttings that there is no need to preserve tubers for propagation.

SEED CONTAINERS

All containers should be thoroughly cleaned before they are used, and the fresh seeds should be placed in the container as soon as dried. They should not be allowed to lie about the barn or bodega for several days, as this invites infestation by weevils and other stored-grain pests. After the seeds have been placed in the containers these should be closed at once.

Clean, dry glass jars and bottles will be found serviceable containers for small amounts of seed. For larger quantities kerosene or gasoline tins will be found to answer the purpose.

In this country it is important that the containers in which the seed is kept are air tight so as to exclude moisture as well as insects.

Little trouble in this respect need be anticipated with jars and bottles, but with large tins a hole of suitable size should be made in the center of the top, say 15 centimeters in diameter. A throat about 5 centimeters high should be soldered around the hole, about 25 millimeters outside of which on the top of the can a flange 25 millimeters high should be soldered. The cover should be made about as high as the throat, and so that it fits over this on the outside. The space between the flange and the throat should be filled with naphthalene. Since when the cover is placed in position its lower rim rests in the naphthalene, this will prevent the entrance into the can of weevils and other noxious insects. See figure 1.

For cultural directions of vegetables and field crops, see circular No. 119.

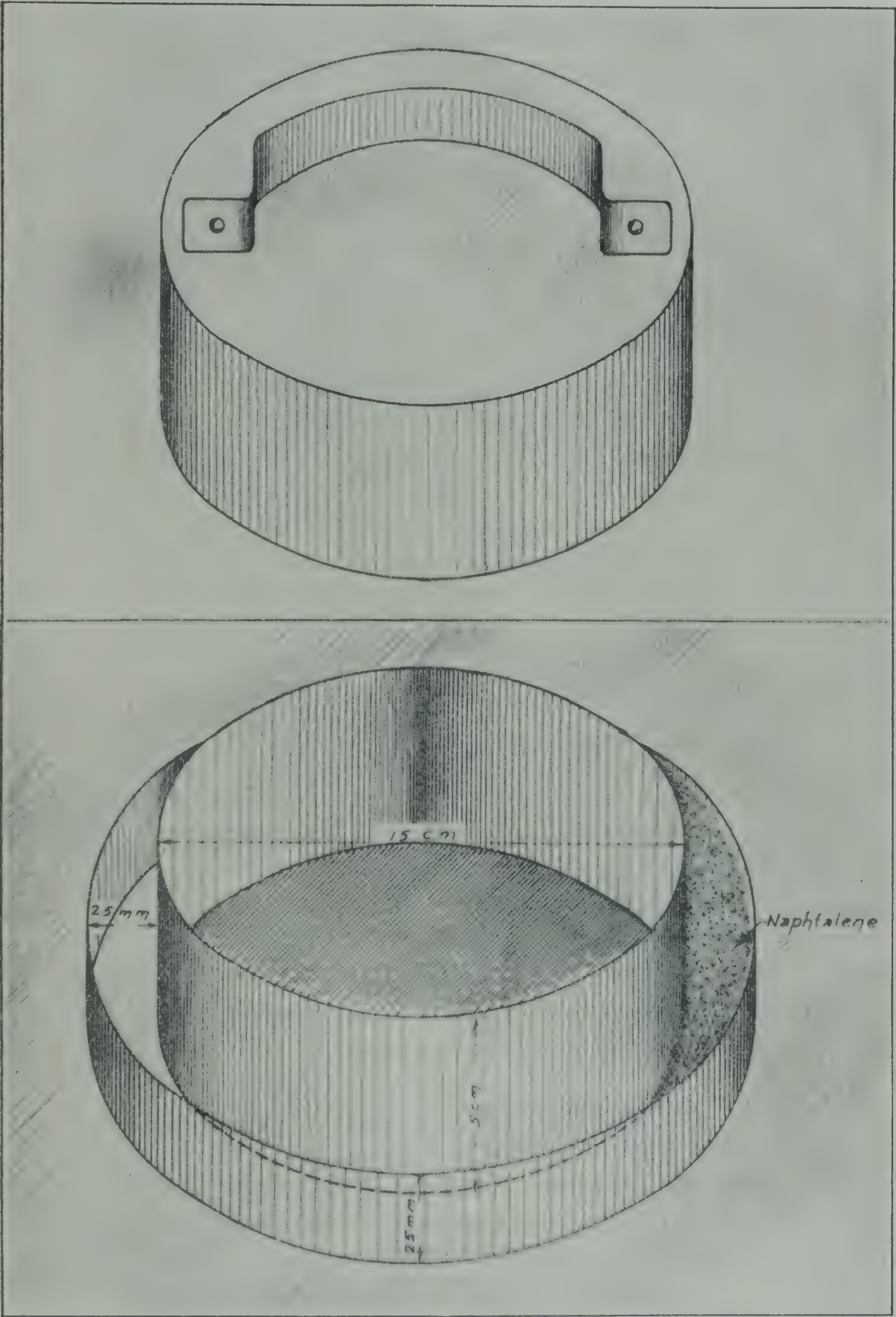


FIG. 1. Mouth and cover for an insect proof seed container.

For a complete list of all the known dialectal names in the Philippines of the plants mentioned in this paper, accompanied by descriptions, see the “Food Plants of the Philippines.”

THE PREPARATION AND PACKING OF SEEDS AND SCIONS OF TREES AND SHRUBS IN THE TROPICS

By P. J. WESTER

INTRODUCTION

In the Temperate Zones practically all seeds may be dried and still retain their viability, whereas in the Tropics the seeds of many species, for instance, such important plants as the tea, coffee, cacao, mango, and the mangosteen, lose their germinative power if they are allowed to dry out. Many years of experience in plant introduction and distribution work by the writer has shown that there is so much confusion in the minds of most people as to which seeds can safely be dried without deterioration, and which must be kept damp in order to germinate that it has seemed advisable to prepare lists of the different fruits found in the Philippines according to how their seeds should be treated.

Among the multitude of timbers and other trees of economic value or woody ornamental plants, though there are many exceptions, it is a safe rule to pack seeds obtained from fleshy or pulpy fruits in a moist medium, while those which ripen dry in their receptacles do not require special packing.

So far as possible, seeds should be obtained only from ripe fruits. If the fruit is not quite ripe when it is picked, it should be laid in a box or on a table to ripen before the seeds are removed. Then, when the seeds are removed from the fruit, they should be washed free of all pulp in fresh water, the pulpy water poured off and the seeds rinsed repeatedly in several waters until the water runs off clear. At the same time care should be taken to see that they are not injured in the course of washing. Excepting seeds with a hard bony shell like the mango, *they should never be scraped with knives or sticks*. The cleaning is facilitated by placing the seeds with adhering pulp (after they have been removed from the fruit) in a box and allowing them to lie and ferment for a day or two, depending on how fast the pulp decays. The seeds can then be easily cleaned of pulp and fruit juice, which make a

favorable breeding ground for fungi, and also attract insect pests if allowed to dry on the seeds.

When the seeds are clean, they should be spread out to dry on a table, a large sheet of Manila paper, or a blotter.

TREES AND SHRUBS THE SEEDS OF WHICH WILL RETAIN THEIR VIABILITY WITHOUT MOIST PACKING

Seeds that are of such nature that they can be stored dry and still retain their germinative power, after being cleaned, should be allowed to lie exposed and dry for a couple of days, being stirred now and then to insure even drying, and then stored away in clean, dry containers until planting time. Or, if they are to be shipped some distance, they may be placed in paper or cloth bags and sent through the mail without further packing than to protect them from mechanical injuries.

Species belonging in this group are as follows:

ALAGA. <i>Uvaria sorsogonensis</i>	CUSTARDAPPLE. <i>Annona reticulata</i>
ALAGADISSO. <i>Annona spinescens</i>	CYNDRA. <i>Cyphomandra betacea</i>
ALAKAO. <i>Palaquium philippense</i>	DALINSI. <i>Terminalia edulis</i>
ANIGLI. <i>Annona senegalensis</i>	DAMIA. <i>Macadamia ternifolia</i>
ANILAU. <i>Grewia eriocarpa</i>	DAO. <i>Dracontomelum dao</i>
ATIBU. <i>Rubus pectinellus</i>	DATE. <i>Phoenix dactylifera</i>
AYO. <i>Tetrastigma harmandi</i>	DAUAG. <i>Capparis micracantha</i>
BAGEJA. <i>Canarium moluccana</i>	DENDE. <i>Elaeis guineensis</i>
BALUKO. <i>Grewia philippinensis</i>	DOWNY MYRTLE. <i>Rhodomyrtus to-</i>
BANAUAK. <i>Uvaria rufa</i>	<i>memosus</i>
BIGNAY. <i>Antidesma bunius</i>	FEIJOA. <i>Feijoa sellowiana</i>
BIKA. <i>Ampelocissus martini</i>	GENIPA. <i>Genipa americana</i>
BIRIBA. <i>Rollinia orthopetala</i>	GISAU. <i>Canarium williamsii</i>
BITUNGOL. <i>Flacourtia indica</i>	GRANADILLA. <i>Passiflora quadrangu-</i>
BLACKBERRY. <i>Rubus nigrobaccus</i>	<i>laris</i>
BRAZIL NUT. <i>Bertholletia nobilis</i>	GRAPE. <i>Vitis</i> , all species
BRITOA. <i>Britoa acida</i>	GUANABANO. <i>Annona muricata</i>
BUNYA. <i>Araucaria bidwillii</i>	GUAVA. <i>Psidium guajava</i>
CAIMITILLO. <i>Chrysophyllum olivi-</i>	GUISARO. <i>Psidium molle</i>
<i>forme</i>	HEVI. <i>Spondias cytherea</i>
CAIMITO. <i>Chrysophyllum cainito</i>	HONDAPARA. <i>Dillenia indica</i>
CAROB. <i>Ceratonia siliqua</i>	IBA. <i>Cicca disticha</i>
CASHEW. <i>Anacardium occidentale</i>	ICACO. <i>Chrysobalanus icaco</i>
CATTLEY. <i>Psidium cattleianum</i>	ILAMA. <i>Annona diversifolia</i>
CEFALUS. <i>Sarcoc e p h a l u s e s c u-</i>	IMBU. <i>Spondias tuberosa</i> .
<i>lentus</i>	INYAM. <i>Antidesma ghaesembilla</i> .
CHERIMOYA. <i>Annona cherimolia</i>	KABIKI. <i>Mimusops elengi</i>
CHESTNUT. <i>Castanea sativa</i>	KABUYAO. <i>Citrus hystrix</i>
CHICO. <i>Achras zapota</i>	KAKI. <i>Diospyros kaki</i>
CIRUELA. <i>Spondias purpurea</i>	KALAMONDIN. <i>Citrus mitis</i>
CITRON. <i>Citrus medica</i>	KALPI. <i>Citrus webberi</i>
COPELA. <i>Rubus copelandi</i>	KAMIRING. <i>Semecarpus cuneiformis</i>

KANARI. <i>Canarium commune</i>	PEACH. <i>Prunus persica</i>
KAONG. <i>Arenga pinnata</i>	PEKOLA. <i>Mimusops kauki</i>
KARANDA. <i>Carissa carandas</i>	PERESKIA. <i>Pereskia aculeata</i>
KAYAM. <i>Inocarpus edulis</i>	PERUNKILA. <i>Carissa sp.</i>
KETEMBILLA. <i>Dovyalis hebecarpa</i>	PHALSA. <i>Grewia asiatica</i>
KOTMO. <i>Vaccinium whitfordi</i>	PILAY. <i>Rubus niveus</i>
KUNAKUN. <i>Elaeocarpus calomala</i>	PILI. <i>Canarium ovatum</i>
LAMIO. <i>Dracontomelum edule</i>	PINEAPPLE. <i>Ananas comosus</i>
LANAGON. <i>Flacourtia euphlebia</i>	POHA. <i>Physalis peruviana</i>
LANNO. <i>Spondias pinnata</i>	POMEGRANATE. <i>Punica granatum</i>
LAURIVA. <i>Psidium laurifolium</i>	POMELO. <i>Citrus maxima</i>
LEMON. <i>Citrus limonia</i>	RAGINI. <i>Rubus rosaefolius</i>
LILIKOI. <i>Passiflora edulis</i>	ROSELLE. <i>Hibiscus sabdariffa</i>
LIME. <i>Citrus aurantifolia</i>	SERALI. <i>Flacourtia ramontchi</i>
LIMON REAL. <i>Citrus excelsa</i>	SONCOYA. <i>Annona purpurea</i>
LINAS. <i>Uvaria purpurea</i>	SUGARAPPLE. <i>Annona squamosa</i>
MANDARIN. <i>Citrus nobilis</i>	TAMARIND. <i>Tamarindus indica</i>
MIARAY. <i>Citrus miaray</i>	TAMISAN. <i>Citrus longispina</i>
MOMBIN. <i>Spondias lutea</i>	TIBAO. <i>Rubus elmeri</i>
MULING. <i>Grewia stylocarpa</i>	TITAO. <i>Rubus ellipticus</i>
NALA. <i>Tetrastigma loheri</i>	TUNGULU. <i>Carissa grandiflora</i>
NARANJILLA. <i>Solanum quitoense</i>	UMKOLO. <i>Dovyalis coaffra</i>
NELLI. <i>Phyllanthus emblica</i>	UVERO. <i>Coccolobis uvifera</i>
ORANGE. <i>Citrus aurantium</i>	VILATTI. <i>Feronia limonia</i>
PALANAU. <i>Rubus fraxinifolius</i>	VOAVANGA. <i>Vangueria madagascariensis</i>
PANIALA. <i>Flacourtia cataphracta</i>	YARUMA. <i>Cecropia palmata</i>
PAPAYA. <i>Carica papaya</i>	
PARCHA. <i>Passiflora laurifolia</i>	

SEEDS WHICH REQUIRE SPECIAL PACKING

Seeds belonging to a class which rapidly loses viability, either must be planted at once after being cleaned, or else packed in a damp medium, such as soil or sand until they are planted.

If such seeds are to be shipped to some other point, after being cleaned they should be spread out thin to dry for about three or four hours, or long enough to allow the excess surface moisture to dry off. While in the process of drying fruit tree seeds in the Tropics should always be kept *in the shade*. It is true that some fruit tree seeds are not injured by the heat of the sun, but many others are more or less injured and frequently killed by exposure to the sun.

When the seeds are sufficiently dried, that is, when the surface moisture has dried off, they should be packed at once in tins or oiled paper, in moist sphagnum moss, coconut fiber dust, or powdered charcoal. Well weathered sawdust makes an excellent packing medium. Just enough clean fresh water should be added to the packing medium so that in squeezing a handful it feels moist *but not wet*.

Excess moisture should be guarded against as that will start premature germination or decay before the seeds arrive at their destination. If oiled paper is used as a wrapper, the package in addition should be wrapped in strong Manila paper for an outer covering before it is placed in the mails.

In all cases, sufficient packing material should be mixed with the seeds to keep them well separated from each other. Thus, if decay starts in some seed it will not spread so rapidly to the others. Especially in bulky shipments, seeds are liable to heat in transit if an insufficient amount of packing medium is packed with the seed.

In remote localities where other good packing material is not procurable, soil, preferably dug from a depth of 20 to 30 centimeters beneath the surface of the land, will serve as a substitute.

All waste space should be filled with packing so that the seeds cannot move about while in transit.

Seeds of the following species require moist packing to safely reach their destination:

ADANG. <i>Eugenia calubcob</i>	CANISTEL. <i>Lucuma nervosa</i>
AGLAÑO. <i>Hedyachras philippinensis</i>	CARAMBOLA. <i>Averrhoa carambola</i>
AKEE. <i>Blighia sapida</i>	CHERPU. <i>Garcinia prainiana</i>
ALPAY. <i>Euphoria didyma</i>	CHICO-MAMEY. <i>Calocarpum sapota</i>
ALUAO. <i>Euphoria nephelioides</i>	CINNAMON. <i>Cinnamomum zeylanicum</i>
ANTOL. <i>Garcinia vidallii</i>	COFFEE. <i>Coffea</i> , all species
AVOCADO. <i>Persea americana</i>	COYO. <i>Persea schiedeana</i>
BACHANG. <i>Mangifera foetida</i>	DALUBI. <i>Zalacca clemensiana</i>
BALUBAT. <i>Eugenia claviflora</i>	DANEALAN. <i>Garcinia subelliptica</i>
BANAGO. <i>Gnetum gnemon</i>	DUHAT. <i>Eugenia cumini</i>
BANANA. <i>Musa sapientum</i>	DUKU. <i>Lansium domesticum duku</i>
BANGAR. <i>Sterculia foetida</i>	DURIAN. <i>Durio zibethinus</i>
BANITI. <i>Garcinia dulcis</i>	GALO. <i>Anacolosa luzonensis</i>
BAROBO. <i>Diplodiscus paniculatus</i>	GANDARIA. <i>Bouea macrophylla</i>
BAUNO. <i>Mangifera caesia</i>	GOMIHAN. <i>Artocarpus elastica</i>
BAYANI. <i>Dillenia megalantha</i>	GRUMICHAMA. <i>Eugenia dombeyi</i>
BAYANTI. <i>Aglaia harmsiana</i>	HUANI. <i>Mangifera odorata</i>
BERBA. <i>Rheedia edulis</i>	IGANG. <i>Eugenia garciae</i>
BINUKAO. <i>Garcinia binucao</i>	INOGUG. <i>Eugenia</i> sp.
BOBONAO. <i>Aglaia everittii</i>	JAK. <i>Artocarpus integra</i>
BORACHO. <i>Lucuma salicifolia</i>	KABANGLA. <i>Garcinia mindanaensis</i>
BREADFRUIT. <i>Artocarpus communis</i>	KALAPI. <i>Calamus ornatus</i>
BULALA. <i>Nephelium mutabile</i>	KALAYO. <i>Erioglossum rubiginosum</i>
BULSO. <i>Gnetum indicum</i>	KAMANCHILE. <i>Pithecolobium dulce</i>
BUNAG. <i>Garcinia benthami</i>	KAMANI. <i>Garcinia rubra</i>
BUOL. <i>Ximenia americana</i>	KAMBOG. <i>Dillenia mindanaense</i>
CACAO. <i>Theobroma cacao</i>	

KAMI. <i>Cinnamomum mindanaense</i>	MANDALIKA. <i>Artocarpus rigida</i>
KAMIA. <i>Averrhoa bilimbi</i>	MANGO. <i>Mangifera indica</i>
KAMINGI. <i>Litchi philippinensis</i>	MANGOSTEEN. <i>Garcinia mangostana</i>
KATURI. <i>Garcinia venulosa</i>	MANKIL. <i>Eugenia mananquil</i>
KUBILI. <i>Cubilia blancoi</i>	MARANG. <i>Artocarpus odoratissima</i>
LAMUTA. <i>Cynometra cauliflora</i>	MATASANO. <i>Casimiroa edulis</i>
LANZON. <i>Lansium domesticum</i>	ONANI. <i>Eugenia lancilimba</i>
LAPINI. <i>Eugenia xanthophylla</i>	PAHO. <i>Mangifera altissima</i>
LEMASA. <i>Artocarpus champeden</i>	PALALI. <i>Dillenia riefferscheidia</i>
LIMONCITO. <i>Triphasia trifolia</i>	PANGI. <i>Pangium edule</i>
LINGARO. <i>Elaeagnus philippinensis</i>	PILDIS. <i>Garcinia dives</i>
LIPOTI. <i>Eugenia curranii</i>	PITANGA. <i>Eugenia uniflora</i>
LITCHI. <i>Litchi chinensis</i>	RAMBI. <i>Baccaurea motleyana</i>
LITOKO. <i>Calamus</i> sp.	RAMBUTAN. <i>Nephelium lappaceum</i>
LONGAN. <i>Euphoria longana</i>	SALAK. <i>Zalacca edulis</i>
LOQUAT. <i>Eriobotrya japonica</i>	SANTOL. <i>Sandoricum koetjape</i>
LUNAU. <i>Otophora fruticosa</i>	TAMBIS. <i>Eugenia aquea</i>
MABOLO. <i>Diospyros discolor</i>	TAMIL. <i>Garcinia tetrandra</i>
MADRONO. <i>Rheedia madrono</i>	TEA. <i>Thea sinensis</i>
MAIGANG. <i>Eugenia polycephaloides</i>	TEBDAS. <i>Calamus mitis</i>
MAKOPA. <i>Eugenia javanica</i>	TERSANA. <i>Eugenia malaccensis</i>
MALABU. <i>Garcinia cumingiana</i>	TULANA. <i>Eugenia aherniana</i>
MALPI. <i>Malpighia glabra</i>	UAY. <i>Calamus usitatus</i>
MAMATA. <i>Lansium dubium</i>	WAMPI. <i>Clausena lansium</i>
MAMEY. <i>Mammea americana</i>	YAMBO. <i>Eugenia jambos</i>
MAMONCILLO. <i>Melicocca bijuga</i>	ZAPOTE. <i>Diospyros ebenaster</i>
MANALAU. <i>Aglaia oligantha</i>	

Other important crops the seeds of which must be packed in a moist medium include Para rubber, abacá or Manila Hemp, nutmeg, clove, and camphor.

On arrival the seeds should be planted at once and not allowed to be exposed and to dry out.

SCIONS AND CUTTINGS

Scions or cuttings should always be made from well matured growths. The leaves and spines, if any, should be cut off with a sharp knife, leaving about two or three millimeters of the leaf-stalks.

In special cases, as with the mango, cacao, or the cherimoya and related plants, where the scions must be naked, if suitable scions are not immediately available on a tree, the leaf blades should be cut off from a number of straight well matured twigs, of about the thickness of a lead pencil. In the course of three weeks, the leaf-stalks will have dropped, and well healed scars have formed upon the twigs. These are then ready to be cut for scions and packed.

It is important that scions and cuttings immediately after being cut from the parent plant, be covered with a moist cloth or plunged into damp sphagnum moss or sawdust until they are being packed for shipment. Much material fails to survive and yield good results because it was carried about uncovered, and exposed to the sun while being carried from the orchard to the packing shed, especially if the leaves were not trimmed off. The evaporation from all living tissue in the Tropics exposed to the sun and hot air in the daytime is far greater than most people realize, but is easily noted by watching how rapidly the leaves and tender twigs wither and dry up on a plant severed from the root and allowed to lie exposed in the sun.

Before being packed the ends of the cuttings should be trimmed off smooth with a sharp knife, after which each cutting should be wrapped separately in damp, soft Manila paper or newspaper before being tied into a bundle, or packed in damp sphagnum moss or sawdust, so that the cuttings do not touch. The bundle should then be placed in a tin or else wrapped in oiled paper to prevent the escape of moisture, outside of which should be placed a coat of corrugated paper, finally wrapped in stout Manila paper.

In the Tropics bamboo joints make good containers for cuttings and scions, but they must be water-proofed for long distance shipments, or else the scions wrapped in oiled paper before being placed in the joint. Vacant spaces in a tin or bamboo joint should be filled with waste paper so that the plant material cannot knock about loosely while in transit.

The different Philippine dialectal names accompanied by descriptions of all the fruits enumerated in this article will be found in the "Food Plants of the Philippines," a publication issued by this Bureau.

THE GOVERNMENT OF THE PHILIPPINE ISLANDS
DEPARTMENT OF AGRICULTURE AND NATURAL RESOURCES
BUREAU OF AGRICULTURE
MANILA

ADMINISTRATIVE ORDER No. 29

REGULATIONS GOVERNING THE IMPORTATION AND EXPORTATION OF
PLANT MATERIALS TO AND FROM THE PHILIPPINE ISLANDS
(REVISED)

The Director of Agriculture is authorized by Legislative Act No. 3027, approved March 8, 1922, to regulate the importation and exportation of plant materials into and from the Philippine Islands, for the purpose of protecting the crops of the Philippines from foreign plant diseases and injurious insects. Pursuant to said Act, the following rules and regulations are hereby promulgated:

SECTION 1. *Definitions.*—For the purpose of these regulations the terms herein used are defined as follows:

(a) “Person” shall mean both singular and plural, as the case demands, and shall include corporations, societies, and associations and their agents and employees.

(b) “Plant materials” shall include living plants, fruits, seeds that can be used for reproduction purposes, cuttings, bulbs and corms, grafts, leaves, roots, scions, and fruit pits.

(c) “Plant Quarantine Inspector” shall mean any person so designated by the Director of Agriculture to act as the latter’s representative and having a written appointment issued by the Director of Agriculture.

(d) “Disinfection” shall mean any treatment applied for the purpose of destroying any infection or infestation that may occur on or amongst plant materials subject to these regulations.

SEC. 2. *Plant materials for which permit is required.*—Plant materials which are governed by special quarantine and other restrictive orders now in force, and which may hereafter be made the subject of special quarantines, may be imported in limited quantities, under permit from the Director of Agricul-

ture, from countries which maintain inspection, for the purpose of keeping this country supplied with new varieties and necessary propagating stock. The same plant materials may also be imported in limited quantities, under quarantine, from countries not maintaining inspection, provided they are to be used for experimental purposes only, subject to such conditions that the Director of Agriculture may impose. The importation of such plant materials for the purposes specified above, shall only be made through the port of Manila, upon compliance with the administrative orders governing them respectively, and with these regulations.

The following is the list of the plant materials which are covered by special quarantines, and the Administrative Orders governing each one of them, respectively:

- Musa and allied plants (Administrative Order No. 30).
- Coconuts (Administrative Order No. 31).
- Sugar Cane (Administrative Order No. 32).
- Rice (Administrative Order No. 33).
- Importation of fruits (list attached) from countries infested with Mediterranean fruit-fly, *Ceratitis capitata* (Administrative Order No. 34).
- Pineapple (Administrative Order No. 35).
- Bamboo (Administrative Order No. 36).
- Tobacco (Administrative Order No. 37).

SEC. 3. *Application for permits for importation of plant materials.*—All persons who intend to import plant materials the entry of which is prohibited under section 2, shall first make application to the Bureau of Agriculture Form No. 251 or Form No. 252, as the case may be. Applications for permit must be made in advance of the shipment of the plant materials.

SEC. 4. *Issuance of permits.*—On approval by the Director of Agriculture of an application for importation of plant materials, a permit will be issued in quadruplicate (Bureau of Agriculture Form No. 253). The original copy will be furnished to the applicant for presentation to the quarantine inspector at the port of entry, the duplicate will be forwarded to the quarantine inspector at the port of entry, the third copy will be furnished the Collector of Customs, and the fourth copy will be filed with the application. Before the issuance of such a permit, however, the Director of Agriculture may, for the compliance with the conditions imposed in these regulations, require the importer to file a bond in the amount of twice the invoice cost of the plants imported.

SEC. 5. *Notice of arrival by permittee or other persons bringing into the country plant materials.*—Immediately upon arrival of plant materials at the port of entry, the permittee or the person bringing into the country plant materials shall submit in duplicate to the Director of Agriculture an application for inspection upon a form provided for that purpose (Bureau of Agriculture Form No. 254) stating the number of permit, date of entry, name of ship or vessel, the country and locality where grown, name of exporter, name of importer, agent or broker at the port of entry, and character and quantity of plant materials.

SEC. 6. *Notice of shipment by permittee.*—After entry of the plant materials and before removal from the port of entry of each separate shipment or consignment thereof, the permittee shall notify the Director of Agriculture on the form provided for the purpose (Bureau of Agriculture Form No. 255) stating the number of the permit, the date of entry, the name and address of consignee to whom it is proposed to forward the plant materials, the amount to be shipped, and the probable date of shipping and route of transportation. A separate report is required of each ultimate consignee.

Plant materials which have been once inspected and passed by a duly authorized plant inspector may be moved from place to place (inter-provincial shipment) without restrictions other than those imposed on the inter-provincial movement of domestic plant materials. To prevent any delay in the shipment and movement of the plant materials the goods covered may be shipped immediately after due notice to the Director of Agriculture. However, the permittee is cautioned that this notice must always be furnished prior to shipment or movement of the plant materials, and that failure to submit these reports prior to the shipment and movement may result in the revocation of permits and the application of the penalties prescribed by the Legislative Act No. 3027.

SEC. 7. *Revocation of permits.*—Permits may be revoked and further permits refused for the importation of the products of any grower or exporter of any foreign country who has violated Legislative Act No. 3027 or any rules and regulations promulgated thereunder; or for the importation of the products of any country where inspection is considered by the Bureau of Agriculture, as the result of its examinations of importations therefrom, to be merely perfunctory, or for the failure of permittee

to give the notice required by these rules and regulations, or for the giving of a false or incomplete notice, or the intentional mislabeling of any shipment, or failure to comply with any rules and regulations issued thereunder. Further, any permit issued by the Director of Agriculture may be revoked by him at any time if in his judgment the interests of the public and the service so require.

SEC. 8. *Conditions of entry; foreign certificate of inspection required; inspection and certification; disinfection or fumigation; freedom from sand, soil, or earth; and approval of packing materials.*—Persons who import or bring in articles bearing certification that they are free from fungi and insects, issued by the inspector from the country of origin, shall be required to present the certificate therefor to the office of the plant inspector. Presentation of such a certificate, however, shall not preclude inspection by the plant quarantine officials of this country if an inspection is deemed necessary.

All persons who intend to import plant materials must submit to the Bureau of Agriculture an application for inspection of incoming plants, upon a form provided for the purpose (Bureau of Agriculture Form No. 256) on or before the arrival of such shipment. All such plant materials shall be inspected upon arrival for parasitic fungi and injurious insects. All plants which are found to be free from insect pests and diseases shall be certified and tagged with Bureau of Agriculture Form No. 257 or stamped. Such plants after having been so tagged or stamped shall then be allowed to enter. Plant materials which are found to be infested by insect pests or infected with diseases shall be returned to the point of origin or destroyed, at the option of the importer; in either case the cost shall be borne by the importer.

Plant materials imported under section 2 hereof shall, at the expense and responsibility of the importer, be subject as a condition of entry to such disinfection or fumigation as may be required by the Plant Quarantine Inspectors, and may be isolated in places designated by the Director of Agriculture until evidence is available showing that no injurious insects or parasitic fungi are present on such plants.

All plant materials offered for import must be free from sand, soil, or earth, and all plant roots, rhizomes, tubers, etc., must be washed to thoroughly free them from such sand, soil, or earth, and must be so certified by the duly authorized in-

spector of the country of origin; *Provided*, That sand, soil, or earth may be employed for the packing of bulbs and corms when such sand, soil, or earth has been sterilized or otherwise safeguarded in accordance with the methods prescribed by the Bureau of Agriculture and certified to that effect by the duly authorized inspector of the country of origin. The use of such sand, soil, or earth for packing materials other than bulbs and corms is not authorized.

All packing materials employed in connection with importations of nursery stock and other plants and seeds are subject to approval of the Bureau of Agriculture as to such use. Such packing materials must not previously have been used as packing or otherwise in connection with living plants, and, except for bulbs and corms, must be free from sand, soil, or earth and must be certified as meeting these conditions by the duly authorized inspector of the country of origin.

SEC. 9. *Plant materials held under quarantine*.—Any case, box, package, or other container containing plant materials which is being held subject to examination or determination as to final disposition, shall have attached to it a quarantine sign (Bureau of Agriculture Form No. 258) clearly indicating to employees of common carriers and the public that the container to which the sign is attached is being held subject to the rules and regulations promulgated by the Director of Agriculture. The movement or shipment of, or tampering with, any case, box, package, or other container containing plant materials having attached thereto a quarantine sign, which sign has been attached by the Plant Quarantine Inspector, is prohibited until such plant materials or the contents of such case, box, package, or other container have been inspected, the quarantine sign removed therefrom and the plant materials or container officially released by such an inspector.

SEC. 10. *Plant materials for which permit is not required*.—Fruits, vegetables, cereals, and other plant products designed for food purposes, or properly dried, and poisoned botanical specimens when free from sand, soil, or earth, may be imported, but subject to the conditions specified in sections 8 and 9 of these regulations.

SEC. 11. *Application for inspection of plant materials for exportation*.—All persons who intend to export plant materials must submit to the Bureau of Agriculture an application for inspection of the plant materials they desire to export, upon a form provided for the purpose (Bureau of Agriculture Form

No. 259) within a reasonable time before shipment so as to allow proper inspection.

SEC. 12. *Certification of plant materials for exportation; certificate of examination of plant materials for exportation.*—If the plants upon inspection are found to be free from parasitic fungi and injurious insects, a certificate (Bureau of Agriculture Form No. 260) shall be prepared and given by the plant quarantine inspector to the exporter to accompany the shipment. A copy of such certificate shall be filed in the Plant Quarantine Office. Plants which show the presence of injurious insects or parasitic fungi will be returned to the exporter without certification. The quarantine inspector shall prepare a certificate in duplicate (Bureau of Agriculture Form No. 261), one copy to be sent to the shipper and the other to be attached to the shipment. Recommendations may be made that such infested plants be destroyed or, where it seems justifiable, recommendations may be made for treating such plants at the expense of the exporter. Under no condition shall certificates of freedom from disease be given for plants which have been raised among other plants which are badly diseased or infested by insects. Caution must be used in issuing certificates and they must be given only after careful investigation of the previous history of such plants. Certification will not be made for plant materials of certain plant species intended for shipment to a country in which their entrance is absolutely prohibited.

SEC. 13. *Fees for fumigation and disinfection of plant materials.*—The following fees are hereby fixed for the fumigation or disinfection of all imported plant materials or parts thereof or of soil or any material whatsoever used for packing or covering same which is determined or suspected to be infected with injurious insects or plant diseases: Fifteen centavos (₱0.15) per lot requiring one cubic meter or less of fumigation gas, and thirty centavos (₱0.30) per liter or less of disinfectant used.

No containers shall be broken, opened, or removed from the port of entry before the plant materials have been inspected and disinfected at the fumigation house of the Plant Quarantine Office.

SEC. 14. *Ports of entry.*—The inspection of incoming plant materials shall be made at the ports of Manila, Cebu, Iloilo, and Zamboanga. Plant materials shall not be admitted at any other port.

SEC. 15. *Incoming plant materials by mail.*—Plant materials entering this country through the post office shall be inspected

by the quarantine officials upon notification of the presence of such materials at the post office. The inspection for the purpose of determining whether such shipment should be passed or destroyed shall be the same as for materials coming through the customhouse. Inspection shall be made in the presence of either the consignee, a post-office official, or both.

SEC. 16. *Annulment of previous orders and regulations.*—All previous orders and regulations, or parts thereof inconsistent with the provisions of this order, are hereby revoked.

SEC. 17. *Penalty.*—Any person who violates any of the provisions contained in this administrative order shall, upon conviction thereof, be punished by a fine not exceeding one thousand pesos, or by imprisonment not exceeding six months, or by both such fine and imprisonment, in the discretion of the court.

(Sgd.) ADN. HERNANDEZ

Director of Agriculture

Approved, December 5, 1923:

(Sgd.) SILVERIO APOSTOL

*Acting Secretary of Agriculture
and Natural Resources*

THE GOVERNMENT OF THE PHILIPPINE ISLANDS
DEPARTMENT OF AGRICULTURE AND NATURAL RESOURCES
BUREAU OF AGRICULTURE
MANILA

ADMINISTRATIVE ORDER No. 30

WHEREAS, the products of the abaca plant, *Musa textilis*, are among the principal exports of the Philippine Islands, the income from that source amounting to more than ₱44,000,000 annually; and

WHEREAS, there are known to exist in foreign countries insects injurious to, and fungi parasitic upon, such related plants as *Musa sapientum* and *Musa cavendishii* which might also affect the abaca plant;

THEREFORE, by authority of the provisions of Legislative Act No. 3027, approved March 8, 1922, the following regulations shall govern the importation of all plants of the genus *Musa* into the Philippine Islands:

SECTION 1. The importation of plants of the genus *Musa* or any unmanufactured parts of such plants is strictly prohibited; *Provided*, That importation through the port of Manila of small quantities of such plants may be permitted in order to secure better varieties for cultivation in this country, in accordance with section 2 of Administrative Order No. 29. Such importation must be made through the Director of Agriculture and must be held in plant quarantine in an isolation station until evidence is available showing that no injurious insects or parasitic fungi are present on such plants.

SEC. 2. Any importation of plants of the genus *Musa* or unmanufactured products of such plants in contravention of the provisions of this order shall be seized by the plant quarantine inspectors appointed by the Director of Agriculture, and shall be immediately exported or completely destroyed according to the decision of the Director of Agriculture or his authorized agents, the plant inspectors.

SEC. 3. Any person who violates any of the provisions contained in this administrative order shall, upon conviction thereof,

be punished by a fine not exceeding one thousand pesos, or by imprisonment not exceeding six months, or by both such fine and imprisonment, in the discretion of the court.

(Sgd.) ADN. HERNANDEZ

Director of Agriculture

Approved, December 5, 1923:

(Sgd.) SILVERIO APOSTOL

*Acting Secretary of Agriculture
and Natural Resources*

THE GOVERNMENT OF THE PHILIPPINE ISLANDS
DEPARTMENT OF AGRICULTURE AND NATURAL RESOURCES
BUREAU OF AGRICULTURE
MANILA

ADMINISTRATIVE ORDER No. 31

WHEREAS, coconuts are one of the main economic plants of the Philippine Islands; and

WHEREAS, the products of the coconut plant are among the principal exports of this country, the income from such products amounting to more than ₱68,000,000 annually; and

WHEREAS, there are known to exist in foreign countries insects injurious to and fungi parasitic upon such plants, which do not yet exist in this country, and which might do serious damage if introduced;

THEREFORE, by authority of the provisions of Legislative Act No. 3027, approved March 6, 1922, the following regulations shall govern the importation of coconut plants or unmanufactured products of the coconut plant into the Philippine Islands:

SECTION 1. The importation of coconut plants or unmanufactured products of the coconut plant is strictly prohibited; *Provided*, That importation through the port of Manila of small numbers of coconut plants may be permitted for the purpose of promoting the knowledge of new and better varieties here, in accordance with section 2 of Administrative Order No. 29. Such an importation must be made through the Director of Agriculture and must be held in plant quarantine under isolation conditions and until it shall be demonstrated that no injurious insects or parasitic fungi are present upon such importation.

SEC. 2. Any importation of coconut plants or unmanufactured products of the coconut plant in contravention of the provisions of this order, shall be seized by the plant quarantine inspectors appointed by the Director of Agriculture, and shall be immediately exported or completely destroyed according to the decision of the Director of Agriculture or his authorized agents, the plant inspectors.

SEC. 3. Any person who violates any of the provisions contained in this administrative order shall, upon conviction

thereof, be punished by a fine not exceeding one thousand pesos, or by imprisonment not exceeding six months, or by both such fine and imprisonment, in the discretion of the court.

(Sgd.) ADN. HERNANDEZ

Director of Agriculture

Approved, December 5, 1923:

(Sgd.) SILVERIO APOSTOL

*Acting Secretary of Agriculture
and Natural Resources*

THE GOVERNMENT OF THE PHILIPPINE ISLANDS
DEPARTMENT OF AGRICULTURE AND NATURAL RESOURCES
BUREAU OF AGRICULTURE
MANILA

ADMINISTRATIVE ORDER No. 32

WHEREAS, the products of the sugar cane, *Saccharum officinarum*, are among the principal exports of the Philippine Islands, the income from such export amounting to over ₱81,000,000 annually; and

WHEREAS, there are known to exist in foreign countries insects injurious to, and fungi parasitic upon, the sugar cane, which do not yet exist in the Philippine Islands; and

WHEREAS, should such insects and fungi be introduced into this country, they would be a factor tending to decrease the productivity of the sugar cane in this country.

THEREFORE, as a measure to protect the sugar-cane industry, by authority of the provisions of the Legislative Act No. 3027 approved March 8, 1922, the following rules shall regulate the importation of sugar cane into the Philippine Islands:

SECTION 1. The importation of sugar cane or any unmanufactured products of sugar cane is strictly prohibited; *Provided*, That importation through the port of Manila of sugar-cane plants or cuttings may be made through the Director of Agriculture, in accordance with section 2 of Administrative Order No. 29. Such importations are to be allowed only for the purpose of introducing new and better varieties of sugar cane, which it is believed may be cultivated to advantage in this country, and are to be held under quarantine at an isolation station until they have been shown to be free from all injurious insects and parasitic fungi.

SEC. 2. Any importation of sugar-cane plants or unmanufactured products of the sugar cane in contravention of the provisions of this order shall be seized by the plant quarantine inspectors appointed by the Director of Agriculture and they shall order the immediate exportation of such plants or their immediate and complete destruction, according to the decision of the Director of Agriculture or his authorized agents, the plant inspectors.

SEC. 3. Any person who violates any of the provisions contained in this administrative order shall, upon conviction thereof, be punished by a fine not exceeding one thousand pesos, or by imprisonment not exceeding six months, or by both such fine and imprisonment, in the discretion of the court.

(Sgd.) ADN. HERNANDEZ

Director of Agriculture

Approved, December 5, 1923:

(Sgd.) SILVERIO APOSTOL

*Acting Secretary of Agriculture
and Natural Resources*

THE GOVERNMENT OF THE PHILIPPINE ISLANDS
DEPARTMENT OF AGRICULTURE AND NATURAL RESOURCES
BUREAU OF AGRICULTURE
MANILA

ADMINISTRATIVE ORDER No. 33

WHEREAS, rice, *Oryza sativa*, is the chief food of the people of the Philippine Islands, and the raising of rice plants forms the principal agricultural industry of the Philippine Islands; and

WHEREAS, injurious insects and parasitic fungi may exist in other rice producing countries which are as yet unexplored agriculturally; and

WHEREAS, such injurious and parasitic fungi if introduced into this country might seriously decrease the production of rice, thereby increasing the cost of production and the price to the customer;

THEREFORE, by authority of the provisions of Legislative Act No. 3027, approved March 8, 1922, the following rules shall regulate the importation of rice plants and untreated rice products into this country:

SECTION 1. The importation of rice plants, seeds, or untreated rice products is strictly prohibited; *Provided*, That importation through the port of Manila of such rice plants or rice products may be made for the purpose of improving the present rice varieties in this country, in accordance with section 2 of Administrative Order No. 29. Such importations must be made through the Director of Agriculture and must be held under quarantine in isolation until they have been shown to be free from all injurious insects and parasitic fungi.

SEC. 2. Any importation of rice plants or untreated products in contravention of the provisions of this order shall be seized by the plant quarantine inspectors appointed by the Director of Agriculture, who shall order to immediate exportation of such plants or their immediate and complete destruction, according to the decision of the Director of Agriculture or his authorized agents, the plant inspectors.

SEC. 3. Any person who violates any of the provisions contained in this administrative order shall, upon conviction thereof, be punished by a fine not exceeding one thousand pesos, or by imprisonment not exceeding six months, or by both such fine and imprisonment, in the discretion of the court.

(Sgd.) ADN. HERNANDEZ
Director of Agriculture

Approved, December 5, 1923:

(Sgd.) SILVERIO APOSTOL
*Acting Secretary of Agriculture
and Natural Resources*

THE GOVERNMENT OF THE PHILIPPINE ISLANDS
DEPARTMENT OF AGRICULTURE AND NATURAL RESOURCES
BUREAU OF AGRICULTURE
MANILA

ADMINISTRATIVE ORDER No. 34

WHEREAS, there is known to exist in the Hawaiian Islands, Spain, France, Southern Italy, Sicily, Greece, Malta, Asiatic Turkey, Egypt, Cape Colony, Natal, British East Africa, Madagascar, Brazil, Argentina, and the northern states of Australia, an insect known as the Mediterranean Fruit Fly, *Ceratitis capitata*, which affects among other fruits the mango, the orange, the banana, the strawberry, carambola, bell pepper, papaya, carissa, sapote, lemon, coffee berry, persimmon, loquat, fig, mangosteen, tomato, alligator pear, and guava; and

WHEREAS, this injurious insect has not yet appeared in the Philippine Islands; and

WHEREAS, such fruits as named above constitute an important part of the food of the Philippine Islands and any injury resulting to them would affect not only fruit growers but consumers as well; and

WHEREAS, the foregoing injurious insect known commonly as the Mediterranean Fruit Fly, *Ceratitis capitata*, totally destroys any fruit which it may enter;

THEREFORE, by authority of Legislative Act No. 3027, approved March 8, 1922, the following regulations shall govern the importation of fruits and vegetables from the above-mentioned countries into the Philippine Islands:

SECTION 1. The importation of all fruits of the species listed herewith is strictly prohibited from Spain, France, Italy, Sicily, Greece, Malta, Asiatic Turkey, Egypt, Tunis, Algeria, Cape Colony, Natal, British East Africa, Madagascar, Brazil, Argentina, the Bermuda Islands, the Hawaiian Islands, and Australasia, with the exception of the States of Tasmania, South Australia, and Victoria in Australia. Importation from these last-mentioned states may be allowed provided that, with each shipment, a certificate be furnished from a properly authorized official of the Australian government guaranteeing that such

shipments originally emanated from the non-infested states of Tasmania, South Australia, and Victoria, that such shipments have not passed through any infested states and such a certificate shall give the last date of inspection of such non-infested regions. Fruits from these last-mentioned states accompanied by such a certificate will be subject to inspection for other injurious insects and parasitic fungi before being admitted. Fruits from non-infested countries will similarly be admitted subject to inspection for other injurious insects and parasitic fungi.

SEC. 2. Any importation of fruits of the foregoing species in contravention of the provisions of this order shall be seized by the plant quarantine inspectors appointed by the Director of Agriculture, who shall order the immediate exportation of such fruits or their immediate destruction according to the decision of the Director of Agriculture.

SEC. 3. Importation of fruits of the foregoing species from the quarantined countries may be made for promoting the fruit growing industry in this country, in accordance with section 2 of Administrative Order No. 29; *Provided*, That such importations be made in small amounts and through the Director of Agriculture, who will have such plants or seeds isolated under quarantine until they have been shown to be free from all injurious insects and parasitic fungi.

SEC. 4. Any person who violates any of the provisions contained in this administrative order shall, upon conviction thereof, be punished by a fine not exceeding one thousand pesos, or by imprisonment not exceeding six months, or by both such fine and imprisonment, in the discretion of the court.

(Sgd.) ADN. HERNANDEZ

Director of Agriculture

Approved, December 5, 1923:

(Sgd.) SILVERIO APOSTOL

*Acting Secretary of Agriculture
and Natural Resources*

LIST OF FRUITS

1. Sapodilla (*Achras sapota*)
2. Acordia (*Acordia* sp.)
3. Sour sop (*Anona muricata*)
4. Sugar palm (*Arengia saccharifera*)
5. Breadfruit (*Artocarpus incisa*)
6. Carambla (*Averrhoa carambola*)
7. Ball kamani (*Calophyllum inophyllum*)
8. Bell pepper (*Capsicum* sp.)
9. Papaya (*Carica papaya*)
10. Dwarf papaya (*Carica quercifolia*)
11. Carisa (*Carissa arduina*)
12. Sapota (*Casimiroa edulis*)
13. Chinese inkberry (*Cestrum* sp.)
14. Star apple (*Chrysophyllum cainito*)
15. Damson plum (*Chrysophyllum oliviforme*)
16. Chinese orange (*Citrus japonica*)
17. Kumquat (*Citrus japonica*)
18. Tangerine (*Citrus nobilis*)
19. Mandarin (*Citrus nobilis*)
20. Lime (*Citrus medica limetta*)
21. Lemon (*Citrus medica limonum*)
22. Grape-fruit (*Citrus decumana*)
23. Shaddock (*Citrus decumana*)
24. Orange (*Citrus aurantium*)
25. Sour orange (*Citrus aurantium* var *Amara*)
26. Wampi (*Clausena wampi*)
27. Quince (*Cydonia vulgaris*)
28. Persimmon (*Diospyrus decandra*)
29. Loquat (*Eriobotrya japonica*)
30. Brazilian plum or Spanish cherry (*Eugenia brasiliensis*)
31. Rose apple (*Eugenia jambos*)
32. Burinam cherry (*Eugenia michelii*)
33. French cherry (*Eugenia uniflora*)
34. Fig (*Ficus carica*)
35. Mangosteen (*Garcinia mangostana*)
36. Mangosteen (*Garcinia xanthochymus*)
37. Cultivated cotton (*Gossypium* sp.)
38. Mountain apple (*Jambosa malaccensis*)
39. Palm (*Lantania pluvachulla*)
40. Tomato (*Lycopersicum esculentum*)
41. Liches nut (*Litchi chinensis*)
42. Mango (*Mangifera indica*)
43. Elengi tree (*Mimusops elengi*)
44. Mock orange (*Murraya exotica*)
45. Banana (*Musa* sp.)
46. Noronhia (*Noronhia emarginata*)
47. Ochrosia (*Ochrosia elliptica*)
48. Prickly pear (*Opuntia vulgaris*)
49. Passion vine (*Passiflora* sp.)
50. Avocado (*Persa gratissima*)
51. Date palm (*Poenix dactylifera*)
52. Strawberry guava (*Psidium catteyanum*)
53. Sweet red and white lemon guavas (*Psidium guayava*)
54. Common guava (*Psidium guayava pomiferum*)
55. Waiawi (*Psidium guayava pyri-ferum*)
56. Peach (*Prunus persica*)
57. Nectarines (*Prunus persica* var. *nectarina*.)
58. Apricot (*Prunus armeniaca*)
59. Plum (*Prunus* sp.)
60. Pomegranate (*Punica granatum*)
61. Apple (*Pyrus* sp.)
62. Pear (*Pyrus* sp.)
63. Sandalwood (*Santalum freycinetianum* var. *littorale*)
64. Eggplant (*Solanum melongena*)
65. Wi (*Spondias dulcis*)
66. Natal plum (*Terminalia chebula*)
67. Tropical almond or winged kamani (*Terminalia catappa*)
68. Bestill (*Thevetia nerifolia*)
69. Grape (*Vitis labrusca*)

THE GOVERNMENT OF THE PHILIPPINE ISLANDS
DEPARTMENT OF AGRICULTURE AND NATURAL RESOURCES
BUREAU OF AGRICULTURE
MANILA

ADMINISTRATIVE ORDER No. 35

WHEREAS, there is known to exist in the Hawaiian Islands, Singapore, and other countries where pineapples are grown extensively, insects injurious to, and fungi parasitic upon, the pineapple, which do not yet exist in the Philippine Islands; and

WHEREAS, several of the insect pests injurious to, and fungi parasitic upon, pineapple plants are also injurious to, and parasitic upon, sugar canes; and

WHEREAS, if such insects and fungi were to be introduced into this country, they would be a menace not only to our pineapple industry but to our sugar-cane industry also;

THEREFORE, by authority of the provisions of Legislative Act No. 3027, approved March 8, 1922, the following regulations shall govern the importation of all varieties of pineapple, *Ananas sativa*, into the Philippine Islands:

SECTION 1. The importation of pineapples or of any unmanufactured products of pineapple is strictly prohibited; *Provided*, That importation through the port of Manila in small quantities of pineapple plants may be made by or through the Director of Agriculture, in accordance with section 2 of Administrative Order No. 29. These must be held in plant quarantine under isolation conditions until it shall be demonstrated that no injurious insects or parasitic fungi are present upon such importations.

SEC. 2. Any importation of pineapple plants or its unmanufactured products in contravention of the provisions of this order, shall be seized by the plant quarantine inspectors appointed by the Director of Agriculture and shall be either immediately exported or completely destroyed, according to the decision of the Director of Agriculture or his authorized agents, the plant inspectors.

SEC. 3. Any person who violates any of the provisions contained in this administrative order shall, upon conviction thereof, be punished by a fine not exceeding one thousand pesos, or by imprisonment not exceeding six months, or by both such fine and imprisonment, in the discretion of the court.

(Sgd.) ADN. HERNANDEZ

Director of Agriculture

Approved, December 5, 1923:

(Sgd.) SILVERIO APOSTOL

*Acting Secretary of Agriculture
and Natural Resources*

THE GOVERNMENT OF THE PHILIPPINE ISLANDS
DEPARTMENT OF AGRICULTURE AND NATURAL RESOURCES
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MANILA

ADMINISTRATIVE ORDER No. 36

WHEREAS, there exist in Japan, China, Australia, New Zealand, Oceania, Africa, Europe, South America, the British West Indies, Cuba, Central America and in some parts of the United States, dangerous diseases of bamboo, including bamboo smut, *Ustilago shiraiana*, which may be introduced into the Philippine Islands by importation of bamboo plants, or cuttings thereof capable of propagation, including all genera and species of the family *Bambusae*, from the above-named countries; and

WHEREAS, if such diseases were introduced into the Philippines they would become a menace to our bamboo;

THEREFORE, by authority of the provisions of Legislative Act No. 3027, approved March 8, 1922, the following regulations shall govern the importation of all genera and species of the family *Bambusae*:

SECTION 1. The importation of bamboo plants or any unmanufactured parts thereof is strictly prohibited; *Provided*, That importation in small quantities of bamboo plants may be made by the Director of Agriculture for experimental and scientific purposes.

SEC. 2. Any importation of bamboo plants or unmanufactured parts thereof in contravention of the provisions of this order, shall be seized by the plant quarantine inspectors appointed by the Director of Agriculture and shall be either immediately exported at the expense of the importer or completely destroyed, according to the decision of the Director of Agriculture or his authorized agents, the plant inspectors.

SEC. 3. Any person who violates any of the provisions contained in this administrative order shall, upon conviction thereof, be punished by a fine not exceeding one thousand pesos, or by imprisonment not exceeding six months, or by both such fine and imprisonment, in the discretion of the court.

(Sgd.) ADN. HERNANDEZ

Director of Agriculture

Approved, December 5, 1923:

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THE GOVERNMENT OF THE PHILIPPINE ISLANDS
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MANILA

ADMINISTRATIVE ORDER No. 37

WHEREAS, the products of tobacco plant, *Nicotiana tabaccum*, are among the principal exports of the Philippines, the income from that source amounting to more than ₱13,000,000 annually; and

WHEREAS, there are known to exist in foreign countries insects injurious to, and fungi parasitic upon, the tobacco plant, which do not yet exist in this country; and

WHEREAS, such injurious insects and parasitic fungi would seriously decrease the amount of tobacco produced in the Philippine Islands;

THEREFORE, by authority of the provisions of Legislative Act No. 3027, approved March 8, 1922, the following regulations shall govern the importation of all plants of *Nicotiana tabaccum* into this country:

SECTION 1. The importation of all plants or seeds of the species *Nicotiana tabaccum* or of any untreated products of such plants is strictly prohibited; *Provided*, That the importation through the port of Manila of such plants, seeds, or untreated products may be permitted for the purpose of securing better or more productive varieties for cultivation in this country, in accordance with section 2 of Administrative Order No. 29. Such importations must be made through the Director of Agriculture and must be held under quarantine in isolation, until they have been shown to be free from injurious insects and parasitic fungi.

SEC. 2. Any importation of such tobacco plants or untreated products in contravention of the provisions of this order shall be seized by the plant quarantine inspectors appointed by the Director of Agriculture, and they shall order the immediate exportation of such plants or products or their immediate and complete destruction, according to the decision of the Director of Agriculture or his authorized agents, the plant inspectors.

SEC. 3. Any person who violates any of the provisions contained in this administrative order shall, upon conviction thereof, be punished by a fine not exceeding one thousand pesos, or by imprisonment not exceeding six months, or by both such fine and imprisonment, in the discretion of the court.

(Sgd.) ADN. HERNANDEZ

Director of Agriculture

Approved, December 5, 1923:

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*Acting Secretary of Agriculture
and Natural Resources*

THE GOVERNMENT OF THE PHILIPPINE ISLANDS
DEPARTMENT OF AGRICULTURE AND NATURAL RESOURCES
BUREAU OF AGRICULTURE
MANILA

ADMINISTRATIVE ORDER No. 38

PROVIDING FOR THE DESTRUCTION OF PLANTS INFECTED WITH
ABACA HEART-ROT AND ROOT-ROT DISEASES

WHEREAS, there exists in certain parts of the Philippine Islands the diseases generally known as abaca heart-rot and root-rot;

WHEREAS, adequate measures should be adopted to prevent the spread and to effect the control of these diseases;

THEREFORE, by authority of the provisions of Act No. 3027 the diseases generally known as abaca heart-rot and root-rot are hereby declared to be dangerous plant diseases and shall be dealt with as hereinafter described:

SECTION 1. Whenever either abaca heart-rot or root-rot or both are known to exist in any locality of the Philippine Islands, the Director of Agriculture or his authorized agent will inspect all abaca plants in that locality, to mark in a suitable manner all plants ascertained to be affected by the diseases, and to issue a notification in writing to the owners, lessees, or person in-charge of abaca plantations, or plants advising them that disease or diseases exist among their plants and to indicate to them what plants are diseased.

SEC. 2. Whenever the Director of Agriculture or his authorized agent shall have issued a notification in accordance with the provisions of section 1 hereof, it shall be the duty of the owner lessee, or person incharge of the abaca plantation or plants having the disease or diseases to destroy every affected plant by cutting it down or digging it up, if necessary, and completely burning the crown and other infected parts thereof.

SEC. 3. Failure to destroy affected trees within a period of fourteen days from the date of receipt of written notification shall be considered *prima facie* evidence of an endeavor to evade the obligation imposed by virtue of this order and shall render the owner, lessee, or person incharge of abaca plantations or plants liable to the full penalties herein provided.

SEC. 4. Any person who, after being duly notified in writing by the proper authority, as herein provided, fails or refuses to comply with the requirements of this order shall upon conviction suffer the penalties provided in section 13 of Act No. 3027, which is a fine not exceeding one thousand pesos (₱1,000), or imprisonment not exceeding six months, or both such fine and imprisonment, in the discretion of the court.

SEC. 5. In order to carry out the provisions of this order, the Director of Agriculture or any person acting in his behalf shall have access at all times into and upon any land occupied by any abaca plant or plants for the purpose of inspection.

SEC. 6. General Orders No. 52 and 55 of the Bureau of Agriculture, respectively, are hereby repealed.

(Sgd.) ADN. HERNANDEZ

Director of Agriculture

Approved, December 5, 1923:

(Sgd.) SILVERIO APOSTOL

*Acting Secretary of Agriculture
and Natural Resources*

THE GOVERNMENT OF THE PHILIPPINE ISLANDS
DEPARTMENT OF AGRICULTURE AND NATURAL RESOURCES
BUREAU OF AGRICULTURE
MANILA

ADMINISTRATIVE ORDER No. 39

REGULATING THE ERADICATION OF COCONUT BUD-ROT

WHEREAS, there exists in certain parts of the Philippine Islands the disease commonly known as coconut bud-rot;

WHEREAS, this disease is a menace to the agricultural interests of these Islands; and

WHEREAS, adequate measures should be adopted to prevent the spread and to effect the control of the said disease;

THEREFORE, by authority of the provisions of Legislative Act No. 3027 the disease commonly known as coconut bud-rot is hereby declared to be a dangerous plant disease and shall be dealt with as hereinafter prescribed:

SECTION 1. Whenever an outbreak of coconut bud-rot is known to exist in any locality of the Philippine Islands it shall be the duty of the Director of Agriculture or his authorized agent to inspect all coconut trees in that locality, to mark in a suitable manner all trees ascertained to be affected by the disease, and to issue notification in writing to the owners, lessees, or persons incharge of coconut plantations, groves, or trees advising them that the disease exists among their trees and indicating to them what trees are diseased.

SEC. 2. Whenever the Director of Agriculture or his authorized agent shall have issued notification in accordance with the provisions of section 1 hereof, it shall be the duty of the owner, lessee, or person incharge of the coconut plantation, grove, or trees where the disease exists to destroy every affected tree by cutting down and completely burning the crown and other infected parts thereof.

SEC. 3. Failure to destroy affected trees within a period of fourteen days from the date of receipt of written notification shall be considered *prima facie* evidence of an endeavor to avoid the duties imposed by virtue of this order and shall render the owner, lessee, or person incharge of coconut plantations, groves,

or trees liable to the full penalties provided by section 13 of Legislative Act No. 3027, which is a fine not exceeding one thousand pesos, or imprisonment not exceeding six months, or both such fine and imprisonment, in the discretion of the court.

SEC. 4. In order to carry out the provisions of this order, the Director of Agriculture or any person acting in his behalf shall have access at all times into and upon any land occupied by any coconut tree or trees for the purpose of inspection.

(Sgd.) ADN. HERNANDEZ
Director of Agriculture

Approved, December 5, 1923:

(Sgd.) SILVERIO APOSTOL
*Acting Secretary of Agriculture
and Natural Resources*

CURRENT NOTES—FIRST QUARTER

By P. J. WESTER

FORCING TROPICAL FRUITS

In the past the seasons of the temperate fruits and a few tropical ones like the citrus fruits, the pineapple, and avocado has been prolonged by planting early and late ripening varieties and by the use of cold storage.

In the Philippines the smoking of the mango trees to force them into fruiting out of season is a well recognized cultural practice, but one that, curiously enough, has never been applied to other fruit trees, though in all probability other species could be forced to fruit at irregular intervals with equal facility. That this has not been already done is due, no doubt, to the fact that no one ever thought of doing so notwithstanding that it has been repeatedly seen that the mango responds to this treatment. As a matter of fact in the Azores the pineapple is also forced into fruiting by smoking the plants, a circumstance which so far as I know has never been recorded in horticultural literature.

In those islands pineapple growing is a considerable industry, but the plants are not grown in this open fields but in houses, under glass. A writer in the *National Geographic Magazine*, Vol. XXXV, 1919, p. 533, states that the smoking process is the result of an accidental discovery made many years ago.

"The furnace in one of the hothouses began to smoke and filled the entire house with fumes. The planter believed that his crop was ruined, but discovered later, to his surprise, that all his plants not only matured more quickly, but also simultaneously. Since then it has been learned that pineapples requiring several years to mature under the old system will show signs of bearing forty days after being smoked, and then mature more evenly.

"The furnaces used for smoking are filled with green grass or foliage and allowed to smoke three nights in succession."

It is probable that a large number of tropical fruits, if not all, can be brought into fruiting at will by smoking, barring of

course in instances where the pollination or setting of the flowers is adversely affected by rains.

Fumigation of the trees under tents has for many years been a standard practice as a means of control of various insect pests in the citrus orchards in Florida and California. Perhaps the time is not so far distant when these will put to use in forcing the trees to flower and fruit out of season. Certainly experiments in that direction would seem worth while. In lieu of the glass houses used in the Azores low canvas tents would probably answer the purpose for pineapples.

Again, a recent article contributed by *Science Service* to a recent number of *Science* would tend to show that the forcing of trees into fruiting may be effected merely by a hypodermic injection of ether. To quote as follows:

STIMULATION OF PLANTS BY ETHER

No longer will useful plants be allowed to sleep out their long winter sleep if a discovery just announced to *Science Service* by Professor David Lumsden of the Federal Horticultural Board, becomes the common property of nurserymen, amateur and professional gardeners, and even farmers. For he has found that if given a "shot of dope," either by the inhalation or hypodermic method, they may be awakened as if by an alarm clock and set to their work of growing and producing flowers or fruit for the pleasure or profit of man.

The drug used in his experiments was the common ether of the hospital operating room, but instead of putting his plant subjects to sleep *it woke them up*. They liked it and seemed to thrive after just one treatment. For example, some plants were taken from outdoors in midwinter when they had to be dug from the frozen ground with picks, were given an overnight ether debauch and the next morning shoots of an average length of one eighth of an inch had sprouted. Kept indoors they continued to grow and flowers were produced weeks in advance of the usual blossoming season.

Roses were taken from the frozen ground and given a hypodermic injection of the same drug. Not only did they sprout and grow but, more important still to the indoor gardener, they were immune to all the ordinary plant diseases that make indoor rose culture a practical impossibility except in large greenhouses. Professor Lumsden has had roses in February, just six weeks from the time the plant was given its stimulating injection.

In the hypodermic method, Professor Lumsden made use of that sometimes formidable weapon, a woman's hat pin. With this a puncture about a quarter of an inch deep was made at the base of the stem of the plant where it joins the root. Then an ordinary hypodermic needle was introduced and half of one cubic centimeter of ether injected. This is the method which was generally used with woody plants such as roses or lilacs.

One of the more important applications of this whole process, according to Professor Lumsden, is that using either method of drugging the plant, every single latent bud or shoot is brought to life. This is not nature's way, as usually only one of three or four ever grows. This may mean much in the culture of plants such as dahlias or potatoes which are grown from tubers. If every latent bud on these tubers could be made to grow they could be cut into smaller pieces and expense of seed saved. What is more, Doctor Lumsden believes that the plants would be more vigorous.

For he is working now to see if these ether treatments, especially the hypodermic sort, do not impart a lasting vigor to the plant, enabling it to resist disease. His experiments with roses strongly indicate this. If they are confirmed, ether "shots" will with plants take the place of the various forms of vaccinations to which the would-be-healthy humans are now subjected.

Finally, there is a mystery in this whole affair which science may some day solve, but of which it now knows little. Ether temporarily stimulates and then profoundly depresses all animal life. With plant life, in moderate doses, it is apparently *all stimulation* with no depression and no injurious after effects, but instead *a life-long increase in strength and endurance*. If science can learn why this is so, much light will be thrown, Professor Lumsden says, upon the secrets of physiological growth.

THE INTRODUCTION OF NEW FOODS AND FOOD CROPS

The Dasheen, a superior variety of the Yautia, *Xanthosoma sagittifolium*, an important root crop in the West Indies, similar to the Gabi, *Colocasia esculenta*, but more productive and more palatable, was introduced into the Southern States about 20 years ago, since which time the U. S. Department of Agriculture has waged a ceaseless propaganda to extend its uses in the United States. Being a new crop and a new food, the Dasheen occupies much the same position in the United States as adlay, the new grain, occupies in the Philippines.

The problems that confront the introducer of new food plants and new foods is so well put and the matter is so pertinent to the Philippines, where 111 species of new food plants have been introduced since 1900, that the following is quoted from a circular letter about dasheens which is being broadcasted by the U. S. Department of Agriculture and received here in the last mail. The statements made here about the dasheen are especially applicable to adlay:

DASHEENS

The dasheen, as the reader may already know, is a delicious, wholesome, and nutritious vegetable. Its food value is not a matter of theory; it has been proved by exhaustive scientific tests.

New things, however, take hold slowly. Most of us know that the tomato, which now ranks very high in the economic importance among garden products, was long grown merely as an ornamental. Even within the memory of people now living, its fruits were considered actually poisonous. And the potato, long established in favor with the peoples of many nationalities, traveled a thorny path to its present position of distinction. The opposition to it in France at one time is said to have been so severe that the government was petitioned to suppress its cultivation.

These facts suggest that merit is not always enough to overcome speedily the popular prejudice or conservatism concerning little-known foods. Dasheens are now grown commercially in the southern United States and numerous people have already made them an important feature of their menu, but education and publicity are needed to extend their use. We who know the value of the dasheen must see that it does not suffer the delay that these other valuable vegetables did in winning general appreciation and popularity.

It is to be expected that a good many people who try the dasheen for the first time will reject it—either because of its newness or, what is more likely, because a failure to prepare the vegetable properly spoils it for them. So it is essential that dasheen growers and others who have learned its true value do what they can to popularize it. Once the merits of the dasheen are generally known, the industry will take care of itself; but in the beginning it needs encouragement, and help.

Habit, it will be agreed, largely determines what we choose for our daily food. We can form the habit of using dasheens at least occasionally. In the matter of these starchy foods, some of us have the bread habit and eat a great deal of bread; others have the potato, sweet-potato, corn-grits, or rice habit, and get our starch mainly from one of these foods. Where dasheens (and other taros), tropical yams, cassava, and the like are common, the eating of one or more of them becomes habitual. *We must spread the dasheen habit!*

Now that dasheens are being grown in our southern States, let not only the growers, but all other people who can get them—and who like good food, like variety, and are interested in seeing the development of a new agricultural industry—begin the occasional use of this valuable new food. The grower himself can add to the variety of his food by using dasheens, while he saves on the purchase of potatoes, for potatoes are not only high-priced in the South, as a rule, but are not equal in food value to the dasheen; potatoes contain more water.

Get the dasheen habit! Study different ways of preparing dasheens until you find at least two or three simple methods that are entirely satisfactory. Make a point of serving them hot from the stove, as soon as done. The dasheen, like other vegetables, can be prepared attractively if interested attention is given to it. Also, it is not more difficult to spoil in the preparation than many other foods. When properly handled, baked, fried, or made into crisps or salad, and so forth—there is no more palatable vegetable than the dasheen. *And the taste for it grows!*

When you have learned how to prepare dasheens acceptably for your own family, demonstrate to your neighbors who do not know how; and if they have the requisite conditions, get them to grow dasheens for their own use—and perhaps for sale. And when you have visitors, whether from far or from near, who do not know the dasheen or who have not

learned to eat it, do not fail to give them an opportunity to eat it properly prepared. *The taste is the test!*

Then remember the tomato and the potato, and help to spread the knowledge of this less-known but equally valuable vegetable, the dasheen.

NEW COFFEE COUNTRY

The new English colony, Kenya, in tropical East Africa, which one sees frequently mentioned in English publications, but which is barely known in America, is heralded as a promising coffee country in a recent issue of *Tropical Life* (London). Coffee grown in Kenya is reported to have sold in London for from £ 70 to 90 per ton.

According to *Tropical Life* one district alone in Kenya has "possibly one million acres of land, virgin soil suitable for growing high class coffee." Apparently there has been quite a "rush" to this new coffee country, as land values have increased from 3,000 to 5,000 per cent in six years. There are already 4,000 acres in coffee and an annual increase of 2,000 to 3,000 acres in plantations is anticipated. One hundred fifty tons of coffee was produced last year, shipped from Mombasa.

It is noted with considerable surprise that Arabian is the coffee planted. Considering the deadly work effected by *Hemileia vastatrix* on this coffee in Ceylon, India, Java and the Philippines, which disease is also present in East Africa one wonders what will happen to the Kenya coffee plantations.

I take this opportunity to recommend *Tropical Life* to our readers as covering tropical agriculture throughout the world and in all its branches as few other publications to-day. Mr. H. Hamel Smith, the editor, is also well known for his excellent books: *The Fermentation of Cacao*; *Coconuts—The Consols of the East*; and *Soil and Plant Sanitation on Cacao and Rubber Estates*.

POLYEMBRYONI IN THE COCONUT

The coconut, *Cocos nucifera*, is normally monoembryonic, though now and then two and sometimes three plants grow from one coconut.

In the Cebu industrial fair in 1921, the author found on exposition two coconut palms one of which had the extraordinary number of 13 plants of various sizes growing from one nut, while another palm at the same exhibit had seven plants growing out of one nut. Among those growing 13 plantlets from one nut the tallest plant was about 3 meters high while the smaller ones did not measure more than about 0.5 meters in height.

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THE PHILIPPINE TOBACCO INDUSTRY—SUGGESTIONS FOR ITS IMPROVEMENT ¹

For the sake of convenience, this report has been divided into four parts, the first embodying agricultural features of the industry, the second dealing with the classification and grading of leaf tobacco, the third dealing with the marketting of the product, and the fourth containing the recommendations of the various committees. It will be noted that while the recommendations are not by any means exhaustive, yet they are considered to be steps in the right direction, inasmuch as they will not disturb local conditions by a sudden change from former tradition and practice to what are accepted to be the most advanced methods in the industry. Consequently, the recommendations of the committee should be regarded from the point of view of the gradual preparation of the various elements in the tobacco industry in the Philippine Islands to accept the more advanced processes observed in other tobacco growing regions of the world.

I. AGRICULTURAL FEATURES

General Conditions in the Cagayan Valley.—The planters plant heterogenous strains of tobacco which produce types lacking uniformity. They do not sterilize the seed beds to prevent the development of damping-off fungus and insects which destroy the plants. In transplanting, they generally pull the plants carelessly and they space them too far apart, thus producing coarse leaves; they are rather indifferent to the productions of sound

¹ Report of the Tobacco Committee designated by His Excellency, the Governor-General of the Philippine Islands to make a survey of the tobacco industry with the end in view of improving actual conditions. The Committee is composed by Col. G. T. Langhorne, Chairman, Antonio Carag, Provincial Governor of Cagayan; Mariano Manas Cruz, Chief, Plant Industry Division, Bureau of Agriculture; Ventura Guzman, Provincial Governor of Isabela; Don D. Strong of the Bureau of Agriculture; Adriano Hernandez, Director of Agriculture; A. W. Prautch, Chief, Rural Credit Division, Bureau of Agriculture; Juan Posadas, Jr., Collector of Internal Revenue; Geo. R. Summers, Assistant to the Director of Education; Fidel A. Reyes, Director, Bureau of Commerce and Industry; Jacobo Fajardo of the Philippine Health Service, and Carlos Fernandez of the Tabacalera Company, members.

leaves; they usually top their plants heavily in spite of good growth; they don't generally harvest by priming, i. e., they don't harvest as soon as the leaves mature; they cure leaf tobacco in haphazard way, sometimes not only wilting the leaves but completely drying them in the sun; and they do not space the leaves in palillos properly for curing purposes. There is at present comparatively a small number of regulation curing sheds in use making the proper curing of leaf tobacco difficult, while the mandalas are not generally prepared properly to cause the leaf tobacco to ferment completely without spoiling its quality.

In the face of these conditions, we find certain difficulties encountered by the planters which must be remedied for the betterment of the tobacco industry in the Valley.

Difficulties.—The planters, for instance, are not induced to produce tobacco of better quality because buyers do not generally discriminate as regards the quality of the material they buy and consequently are not prone to pay good prices; and they are reluctant in curing leaf tobacco properly, as they do not receive the corresponding price for better cured tobacco. In the case of building regulation curing sheds, it has been found out that not every farmer has the means of putting up such a curing shed for his use; for instance, a small planter cannot put up a shed costing him at least ₱150 when his harvest would only sell for an average of ₱240. Moreover, in the Cagayan Valley, the curing sheds are mostly destroyed annually by the typhoons or floods and it is difficult to get the specified kinds of timber because of the distance of the forests from the tobacco fields. Another difficulty met with is the lack of faith of the average grower in the publications on tobacco issued from time to time, since he regards them as purely theoretical. Furthermore, the farmers on the whole lack money that might enable them to visit experiment stations or attend tobacco conferences; while, on the other hand, the Bureau of Agriculture at present has only two agricultural extension agents due to the retrenchment policy of the Government and they can hardly attend to the agricultural problems of the farmers.

II. CLASSIFICATION AND GRADING OF LEAF TOBACCO

Administrative Order No. 35, as amended by Administrative Order No. 54, of the Bureau of Internal Revenue, governing the classification of leaf tobacco has been carefully gone over by the subcommittee on grading. It was found that the classification of leaf tobacco therein contained is substantially the

same as the classification in vogue during the Spanish tobacco monopoly.

The passage of Act 2613 placed in the hands of the Government an undertaking "to improve the methods of production and the quality to tobacco." This undertaking includes the matter of leaf tobacco classification. To bring about proper classification, the regulations referred to above have been promulgated. The tobacco dealer has been, and is actually the one principally concerned in the compliance with these regulations, but the anomalies which have developed and which need to be eradicated for the benefit of all demand that the said regulations should extend to the tobacco producer as well. Two ways are therefore submitted by which proper tobacco classification by the producer can be effected, i. e., (1) by compulsion, or (2) by educating the farmers in the advantages of coöperative associations and by making such associations exert their persuasive influence in bringing home to the growers the value of proper grading.

As stated above, the classifications of leaf tobacco is not applicable to the producer who sells his crop to a registered tobacco dealer at the place of production. This circumstance has led to the practice of many planters to dispose of their tobacco "in palillos" without being classified, and thus the classes of the tobacco sold are uncertain. The growers complain that the buyer is trying to place him at a disadvantage by offering a low price for his tobacco while the latter believes that he is being misinformed by the former as to the classes of his crop. Proper grading will eliminate this apparent misunderstanding. There are marked advantages for the grower if he undertakes the classification of his tobacco; (a) the tobacco is in its most appropriate form for classification while it is in his hands; (b) he can demand better prices for his tobacco properly classified; (c) the buyer will be induced necessarily to pay good prices on classified tobacco as he would know just exactly what he is buying and furthermore he would be saved the trouble of having a classification made, and (d) the present mutual distrust between the planter and the buyer would be eliminated.

The actual practice of letting the buyer take care of the classifications is not desirable. After the tobacco is purchased by him, it needs to be handled several times. It is transported to his warehouse in carts, piled there, and after this operation, it is again removed from the piles and rehandled for its classification. This process causes considerable breakage of leaf and therefore entails considerable loss on the part of the buyer.

Besides, the buyer has to incur additional expenses for labor in order to make this classification. The advantages in having the planter undertake the classification of his tobacco before he sells it are therefore evident.

The work of the Government in endeavoring to effect proper tobacco classification, in so far as the grower is concerned, has been limited only to persuading him to classify his tobacco before selling it. One of the purposes in adopting a solution for the discord between planters and buyers is to do away with certain anomalous practices in connection with the purchase and sale of tobacco.

MARKETING

Description of method.—Briefly, the marketing method in the Cagayan Valley is as follows:

As a general rule, all large buyers of tobacco employ agents in the tobacco producing districts. These agents commence work before the tobacco crop ripens. They go to the fields and size up the probable quality and quantity expected to be gathered by each planter and they report the prospects to their respective principals. So, the said buyers can more or less figure out what quantity of tobacco they can secure from each district. After the crop is gathered and the planter is ready to sell it, the agents or brokers go to the said planter and offer a certain price for his tobacco. It is the broker that fixes the price for the planter's crop and upon the agreement of the latter, the transaction is closed and the buyer issues a "papeleta" to the grower with the condition that the latter shall transport the tobacco to the warehouse of the former's principal.

The agents or brokers claim that upon their inquiry the grower does not disclose the true quality of his tobacco so that a feeling of distrust is entertained by him against the planter. However, on certain occasions, when competition to buy tobacco is keen the buyers or brokers are not guided by the quality of the tobacco for it is their purpose to purchase as much tobacco as they can.

On the other hand, the grower is always distrustful of the buyer in view of the fact that he is of the belief that the said buyer is always making efforts to place him at a disadvantage by offering a very low price for his crop. Such feeling of distrust becomes more serious upon the delivery of the tobacco by the grower at the warehouse designated. The grower alleges that in most cases he does not receive the price originally offered him by the buyer's agent, for his tobacco, for when he reaches the warehouse his tobacco is reclassified and the price appearing in

the "papeleta" issued him disregarded. Such reclassification always results in the reduction of the price of the tobacco, and the principal buyer refuses to buy it if the grower does not accept the second price offered. The grower claims that it is then when he is taken advantage over because at any rate he is obliged to dispose of his tobacco in view of the necessity to secure money for his family's needs. Furthermore, the difficulty of transporting back home the tobacco obliges him to accept the second price offered.

The "papeleta" system.—Under the system of buying on the "papeleta" it is alleged that the buyer acquires the right to buy the grower's tobacco upon an advance of a nominal amount of money. Upon the issuance of the "papeleta" the buyer believes that the grower assumes the obligation to deliver the tobacco purchased and not sell it to any other buyer.

The grower, on the one hand, believes that by the use of the "papeleta" he is placed at a disadvantage. As pointed out above, he is required to take the tobacco for which a "papeleta" has been issued to the warehouse of the buyer, but upon delivery he, in most cases if not in all, suffers a reduction of the price of his tobacco. Consequently, he complains against the "papeleta" method as prejudicial to his interests.

The buyers on the other hand claim that contracts by means of the "papeleta" are recognized by the courts of justice to be legal, and for this reason the said buyers depend upon the term of the "papeleta" in enforcing their rights if the planter does not comply with his obligation to deliver the quantity and quality of tobacco contracted for. It is not strange, however, that upon delivery, the quality of the tobacco delivered differs from that appearing on the "papeleta." This is due to the fact that the contract was not based upon the actual quality of the crop but merely upon an estimate. Under the circumstances, the planter is convinced, as above indicated, that he is the one prejudiced in the last analysis. If the "papeleta" is a valid document as an evidence of a contract, the terms thereof should operate equally upon the contracting parties, that is, upon both the buyer and the grower, and thus, the buyers will become more careful in indicating the proper quality of the tobacco on the "papeleta" issued by them.

Pernicious effect of present method.—The practice as indicated in the foregoing paragraph governing the purchase and sale of tobacco have, as a consequence, developed the present situation in the Cagayan Valley. There is a continuous discord between

the buyer and the planter with the former having an apparent advantage because of his intelligence and financial means.

Under the present method of marketing there is absolutely no incentive for the planters to produce better leaf. The buying and selling of assorted lots (*uno con otro*) generally prevailing in the Valley is not conducive to the production of better leaf, as no premium is paid in quality.

It is a fact that the tobacco goes through many hands before it reaches the manufacturer or exporter. As a consequence, the compensation of the intermediaries is added to the price of the tobacco. Their elimination will, it is believed, result to the benefit of the planters as they will get good prices for their tobacco, as well as the buyers for the reason that they will not need as much outlay as they employ at present.

IV. RECOMMENDATIONS

AGRICULTURAL FEATURES

(a) To secure the coöperation of the provincial and municipal officials, and of the officers and employees of the Bureau of Internal Revenue, Commerce and Industry, Education, and Forestry, the Philippine Health Service, and the College of Agriculture of the University of the Philippines for the proper functioning of the Bureau of Agriculture, in connection with the work on cultivation, curing and fermentation of leaf tobacco.

(b) To provide funds for traveling and other incidental expenses of non-government employees visiting the tobacco stations of the Bureau of Agriculture or attending a tobacco conference in a barrio or town within the tobacco region, from the Tobacco Inspection Fund of the Bureau of Internal Revenue under Act 2613.

(c) To employ College of Agriculture graduates as tobacco inspectors (Tobacco Extension Agents) for the different tobacco regions of the Cagayan Valley. These tobacco extension agents are to be given at least ₱1,200 per annum each from the Tobacco Inspection Fund under Act 2613 of the Bureau of Internal Revenue.

(d) To issue a catechism¹ and publish posters on better leaf tobacco production in English, Spanish, and native dialects.

¹ A catechism on leaf tobacco production may be obtained free of charge by applying to the Director of Agriculture, Manila, P. I.

(e) To make a more rigid campaign for better leaf tobacco production among the farmers, as follows:

(1) To use better strains of tobacco producing an ideal type of leaf, not less than 30 centimeters long, wide, with rounded tip and base and with thin veins widely separated and forming either an obtuse or a right angle with the midrib, and with a light (*claro*) color when properly cured and fermented.

(2) To sterilize the seedbed by heating, before preparing it for planting, either by burning thrash over the surface of the soil or by pouring hot water over it.

(3) To advise the planters to limit their crop to what can be properly handled and plant at least $\frac{1}{10}$ of it at closer distance, viz.: in hills 50 centimeters apart in rows 75 centimeters to 1 meter apart, depending upon soil fertility and to transplant the plants together with balls of earth so as not to interrupt their growth in the field and thus producing finer leaves; to use more patience and labor in controlling leaf-eating insects such as tobacco worms; to take better caution in topping the plants; and to harvest the leaves in the right stage of ripeness and by priming only.

(4) The curing of leaf tobacco in regulation curing sheds should be made more general. However, the existing Government regulations relative to the curing of leaf tobacco and the building of curing sheds should be amended to the effect that leaf tobacco may be partially cured in the sun (for wilting purposes only), the length of time or number of days to depend upon the texture of the leaves and the weather conditions. As to the length and width of the tobacco curing shed and the kind of materials to be used in building it, the matter is to be left to the discretion of the growers. The floor of the curing sheds should preferably be made of tamped clay or bamboo.

The building of community curing sheds may be necessary for those planters who can not build one for each.

(5) Leaves for curing should be put in "palillos" each to contain not more than 100, preferably 50 leaves, allowing a finger space between the leaves.

(6) The piles or mandalas should be 5 meters square and 3 meters in height, whenever possible. The mandalas should be taken down or undone for the first time as soon as the temperature of 38° C. is reached, and then rebuilt. The throwing down and rebuilding to be repeated when the temperature gets up to 42° C., 46° C., 50° C., and finally to 52° C. or when the fermentation is completed. In this work, a thermometer is indispensable unless the work is to be done by a very experienced man.

(7) The following sanitary measure should be observed:

Mandalas should not be piled except on floors built about 2 feet from the ground and covered with clean mats.

Premises wherein baling is done must be maintained at all times in clean and sanitary condition.

(f) It is believed that a course in tobacco culture, classification, and grading should be given in the public schools established in the various tobacco-producing regions.

CLASSIFICATION AND GRADING

(a) To amend subparagraphs 1 and 2 of subsection (b) of section 6 of Administrative Order No. 35 so as to read as follows:

“(1) *Pinoños*.—The leaves are taken from the pole on which strung for drying, and classified [as to] IN UNIFORM size, soundness, color, and texture, and [leaves of the same classification] gathered into bunches (*pinoños*) of [not more than 50] TWENTY leaves to the bunch [the number depending upon the size of the leaves] and tied together with twine or fiber at the stems. If the packer so desires, he may, before baling, further gather [four] FIVE *pinoños* together, and tie them at the stems, in the middle, and at the tips, forming what is known as a ‘carrot.’

“(2) *Old-style hand*.—The leaves are taken from the pole on which strung for drying and classified [as to] IN UNIFORM size, soundness, color, and texture.

“The leaves are then folded along the midrib so that the under side (dorsal aspect) of the leaves faces out, and TEN leaves of the same classification gathered into bunches (*manojitos*) and [a number] TEN of these bunches tied together into a hand in such a manner that the midribs are exposed. Each hand is tied at each end and in the middle with twine or fiber.”

(b) Likewise, section 5 of Administrative Order No. 35, as amended by Administrative Order No. 54, should be amended by the addition of paragraph (f) to read as follows:

“(f) Leaf tobacco before being sold in the Philippine Islands, either for domestic use or consumption or for export, must first be classified in accordance with these regulations; *Provided*, however, that the classification herein required to be made shall not be understood as prohibiting the grower to sell leaf tobacco in ‘palillos’ by the lot once such tobacco has been duly classified.”

MARKETING

To establish coöperative marketing associations.

Among the beneficial effects of coöperative associations will be: First, the gradual and, in the end, the complete elimination of “corredores” or brokers; second, the abolition or modification of the “papeleta” system; third, all transactions will be based on classification; fourth, general improvement of the tobacco industry through scientific and educational campaigns undertaken by all associations; fifth, extension of credits based on crops or real property, thus doing away with usurious advances on crop liens; and sixth, termination of the continuous discord between buyers and planters with the consequent cultivation of the desirable mutual relations between these two elements.

It is believed that the buyers will be benefitted by the operation of coöperative associations. Where at present they have to deal with hundreds of small planters, under the coöperative plan they

would deal with only one association in every town where they do business. In this way, the buyers will save time and patience, the whole procedure will be more in accordance with modern business methods, and there will be less litigation for the buyers will be dealing with responsible associations.

The interests of the tobacco buyers and the planters are closely intertwined. The former desire good tobacco and fairly abundant supply of it, but the latter have but a limited production under present conditions. There is no doubt that coöperative associations will improve conditions in the Cagayan Valley; therefore, the coöperative movement ought to merit the support of the tobacco buyers. However, objection is interposed by the tobacco buyers on the ground that in associations of this kind usually a few dishonest officials take advantage of the rest. But it is submitted that with the associations projected by the Bureau of Commerce and Industry strict Government supervision through the district auditors or their deputies, or through the provincial treasurers or their deputies, is contemplated. Furthermore, the Bureau will have traveling agents who will see to it that those associations are managed properly.

In order to operate coöperative associations successfully, it is believed imperative to enlist the coöperation of the big buyers. Such coöperation can be secured in view of the fact that the operation of the said associations is not aimed at the beneficial results they bring to the growers only but also at the convenience and advantages afforded the buyers and the benefit of the tobacco industry in general as well.

TURKEY RAISING

By CARLOS X. BURGOS, *Animal Husbandman*

The purpose of this article is to satisfy in some way the increasing demand for information on the subject of Turkey Raising which comes to this Bureau from the public.

STATISTICS

According to the figures obtained from the census of 1903 and from that of the 1918 which are given below, there was in 15 years an increase of 18,000 turkeys in the Philippines and the average prices per bird was ₱4 in 1918 as against ₱3 in 1903.

Census year	Number of turkeys in the Philippines	Value	Killed yearly for table use
1918.....	27,754	₱103,859	7,129
1903.....	9,201	27,878	2,456

The 1918 Census also gives the following provinces with over 1,000 head of turkeys:

Province	Number
Bulacan ¹	4,851
Rizal ²	3,038
Pampanga ³	2,536
Iloilo ⁴	1,914
Pangasinan	1,869
Cagayan	1,462
Occidental Negros.....	1,300
Manila	1,218
Ilocos Norte.....	1,098

¹ The municipalities of Hagonoy and Paombong having 1,373 and 609, respectively.

² The municipality of Binañonan having 1,726.

³ The municipality of Masantol having 534.

⁴ The municipality of Janiway having 686.

It is interesting to note that Luzon Island far surpasses the other islands in this production.

THE NATIVE TURKEY

The Spanish writers of the early occupation of the Philippines do not mention in their writings that turkeys were found in the Islands, although, they mention other domestic fowls and animals. It is therefore most likely that the present day Philip-

pine turkey was only introduced by the Spaniards from Mexico as the turkeys are supposed to be of American origin and Spain controlled these Islands largely through that dependency.

The Philippine turkeys are very small as compared with the Bronze turkeys but most of the former, the dark ones, have a close resemblance in color to the latter breed.

A comparison of the weights of turkeys made at the Alabang Stock Farm gave the following averages:

	Bronze	Native	Mestizo bronze
	Kg.	Kg.	Kg.
Toms.	12.5	5.8	7.2
Turkey hens.	5.4	3.4	4.5

The small size of the present day Philippine turkey may be due to continuous in-breeding of unselected stock and inadequate feeding since their introduction.

CARE OF THE TURKEYS

The usual practice here of the average person who owns some turkeys is to let them run in the same yard with other fowls and to let them roost on the same perches or trees. In this way they keep fighting all the time and unsatisfactory results are obtained. This practice is not so bad if there is plenty of range and there are separate roosting places; but better results could be had if turkeys are kept separate from other stock.

To begin with, it is best to select a place that drains well during the rainy weather. A sandy loam soil with the necessary ditches will do well although hilly sections are best, provided of course, that there is a wide run that is rich in grasshoppers and other insects and tender buds. Turkeys also relish seeds of weeds and grasses. Wide, semi-wild conditions as these will not only reduce cost of care and feed but will prevent diseases in the flock.

Adult turkeys may be allowed to roost in the open but during stormy and rainy nights, it is always hard on them so it is a good system to have a shed where the turkeys may roost and be protected from the rain. An open shed surrounded with poultry wire netting will not only protect them from theft but will also serve to protect them from the Musang (*Paradoxurus philippinensis* Jourdan) and other destructive animals. If not confined at night, they soon become wild. Confining of turkeys in small inclosures most always is discouraging and should not be adopted.

For this purpose a fair-sized orchard, say from 3,000 to 4,000 square meters would be a satisfactory place for one gobbler and eight hens. There will be plenty of range and shade for them and they will serve to reduce the insect pests. A hog-proof wire fence, one and one-quarter meters high, will be sufficient to keep them in. With good every-day care, turkeys will keep in thriving condition and will give good returns to the one in charge of a flock.

The adult turkeys should be fed at least every afternoon with a mixture of equal parts of a variety of whole grains, as palay, corn, Momungan edible adlay, Baso sorghum, mongo, peas, cad-yos, etc., and should have free access at all times to grit, charcoal, pounded oyster shells and clean drinking water. Table and kitchen scraps can also be used to advantage. Instead of throwing into the garbage pail the surplus rice, the potato, banana and papaya peelings, the cabbage, pechay, and lettuce leaves, the yamas (from coconuts), the meat, fish and shrimp scrap, and all other still useful waste including clam and oyster shells (the last two should be pounded into small pieces and placed in boxes) feed them to the turkeys.

In Rizal Province many people feed the adult turkeys with all they will clear of a mixture of two parts tiqui-tiqui (rice bran) and one part finely chopped banana trunk, morning and afternoon, and allow the birds to balance their ration from whatever insects and weed seeds they find on the range. Palay and corn are seldom fed.

MANAGEMENT OF THE FLOCK

One vigorous tom will do for as many as 10 hens, but one male to six or eight females is the best on the average. For one hectare of land from 20 to 30 hens may be kept.

Do not breed turkeys less than a year old.

In selecting, strength and vigor are the first points to consider as poor parent stock will mean weak germs and consequently weak poults. The head should have a clean and healthy appearance. The form must be compact and the breast and body long and deep. Sturdy shanks and toes and strong-sized bones indicate physical vigor.

To avoid in-breeding, it is a good policy to have new toms at least every three years from far off farms that are not related to the flock. This, however, is a somewhat dangerous procedure for it may bring disease into a flock but it is up to the

person buying to make sure that there is no disease where he gets his new tom and to take precautions by quarantining the new comer in a separate compartment for sometime about 2 to 3 weeks. The best hens raised on the farm should be reserved for breeding and should not be sold just because a good price is offered for them. If this is not done, after a while there will be only inferior stock left that will produce weak poults which will easily become sick and die. On the other hand, all the undersized females should be disposed of as it must be remembered that size and physical vigor come largely from the females. The toms need not be over-large, a medium sized one should be preferred as this would serve to protect the turkey hens during breeding.

Mating.—In small flocks it is better to have only one male to insure fertility of the eggs. One good mating will be sufficient to fertilize the whole clutch of eggs the turkey hen will lay. If the service was not good, due to the disturbance by another male, the eggs will likely be infertile, as the female will afterwards pay him little attention and be more busy looking for a nesting place. It is a good idea to trim the nails of the toms in order to protect the backs of the females while mating.

Turkey hens always prefer secluded places and for this purpose empty barrels will do if placed on their sides under brush and shady places. The "tikles," a wide mouthed basket used in Bulacan, is also good and cheap. Put enough rice straw in them and try to protect them from rain. The turkey hens will soon adopt them.

The hens lay, on the average, about 16 to 20 eggs but, of course, 15 eggs for each sitting is sufficient and the difference of this number should be taken out unless the eggs are put under chicken hens; as is customarily done in this case, give each chicken hen not more than nine eggs. The eggs laid should be gathered daily and precautions should be taken not to let the turkey hen discover it is being done. Only leave the last egg or better still use one or two China eggs. The incubation period of turkey eggs is 28 days on the average.

As soon as the turkey hens sit, every precaution should be taken to protect the eggs from crows and snakes and rats. Also a new nesting material should be provided. The turkey hen should be dusted twice a week with some good lice powder in use as sodium flouride, to protect the poults when they hatch. Furthermore, close supervision should be exercised over the nest once in a while to see that there are no mites and lice in it. The eggs should be tested on the 10th day by candling in order to separate the infertile ones and those that may have dead germs.



Bronze tom with newly weaned young turkeys. It will be noticed that there is a pure bred off-colored poult very much alike the light colored native turkeys

In the Alabang Stock Farm where turkeys have been raised since July 8, 1921, it has been observed that turkeys lay eggs throughout the year although during the rainy weather (June, July, and August, there is a marked decrease in the number of eggs laid—it is at this time when most of the hens are molting.

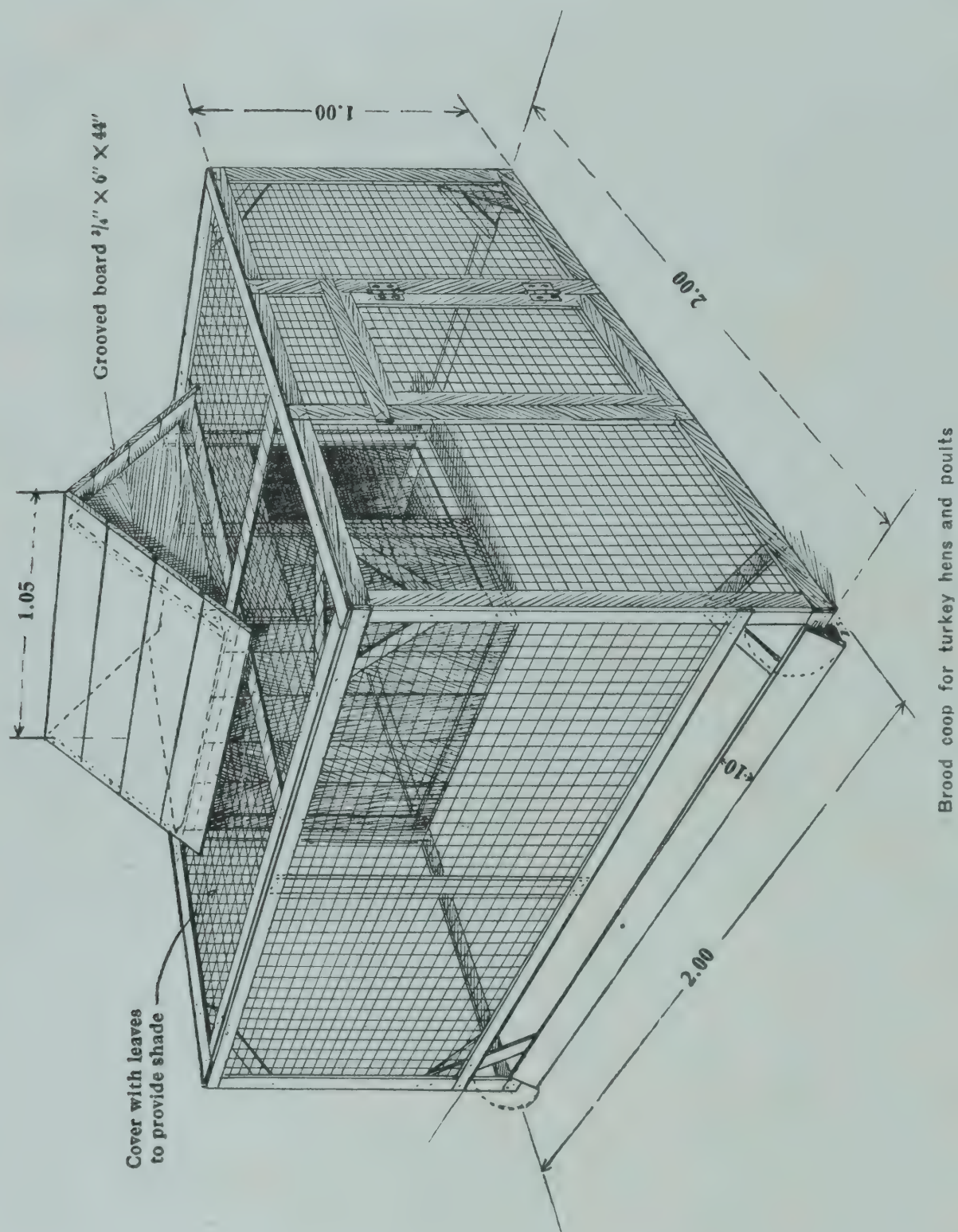
CARE OF THE POULTS

The most important thing to know in the raising of poults is that they need good care and attention. For the average person who can give only a few minutes every now and then but neglects his flock most of the time, failure with a big "F," is the most he can expect. Shiftlessness won't do. Natural love for the work and good will to attend to it at regular intervals and daily, too, have been responsible for the success of the successful turkey raisers.

A brood coop that is roomy enough and will protect the brood from rain, sunshine, and vermin should be built for every turkey hen—Figure 1 illustrates one that may serve as a model. This coop should be strong but light enough to facilitate moving from place to place daily or every two days so as to keep the floor clean. Always select a dry place for it. Keep the mother hen in the coop to protect the poults from getting wet. In favorable weather and when the poults are a week old or over, the big door may be opened to allow the hen and the brood a free range. It is, however, better to wait for the dew to dry before turning the poults outdoor. During uncertain weather keep them in the brood coop. It must be remembered that rain is fatal to poults less than one month old. Examine the coop often for insect parasites as these will weaken and kill the poults. The ordinary small red ants are one of the worst enemies of young poults. Musangs, iguanas, snakes, crows, hawks will prey on the poults if not protected.

Feeding the poults.—Do not feed the poults the first two days as they have enough food in their system to keep them in healthy condition.

On the third day give them finely cut green feed, a little bread and milk and hard boiled egg, chopped fine, shell and all. Clean water and coarse sand may be given to them also. It must be remembered that the poults are not as intelligent as chicks are and they must be keenly observed during the first few feedings. See that they know how to eat as sometimes they will seem to be picking when in fact they are not and have only an empty crop. Hand feeding of poults needs practice but it is





A two-year old Bronze tom

the best as it assures that every poult eats and in this way it gives every one a good start. Up to three weeks of age, feed four or five times daily any of the following:

(1) Hard boiled eggs, chopped fine, mixed with three to four times its bulk of bread crumbs and moistened with milk. Give fine-chopped onion tops and lettuce leaves.

(2) Stale bread soaked in milk and squeezed dry, mixed with moistened common chick feed consisting of 3 parts "binlid," 7 parts tiqui-tiqui, 2 parts ground mongo, one part copra meal, and 1 part ground corn. One part steel-cut oats or one part ground adlay is a good addition.

(3) The general practice in these Islands is to feed the 2 to 4-day-old poults with a little coarse ground black pepper to make them feel warm. The main food is warm cooked rice and "alamang" (small shrimps) fed every two to three hours. One-half liter of "alamang" being sufficient for 20 poults. At about 8.30 to 9 a. m., they are allowed free range.

When feeding poults the following points should be remembered:

Do not feed sloppy food.

Do not overfeed but do not under-feed.

Always feed on clean boards or wooden trays and never on the bare ground, and keep always, where it is accessible, finely broken wood charcoal, grit and water.

The fourth week only chick feed may be given 3 times a day but they should be allowed free on the range. A little finely cut fresh meat or small fish and shrimps should be given when not allowed free range.

From the ninth week and over they should always be on free range. The morning feeding may be omitted. Give scratch grains late in the afternoon such as equal parts of palay, corn, sorghum, Momungan adlay, and mongo. Remember that a variety of grains is good for proper development.

In changing from one food to another make the change gradual.

III. MARKETING

During Christmas and Thanksgiving, and other important holidays, there is always a demand for turkeys and there are very few feasts in Manila where a stuffed turkey is not an important course. The price paid for turkeys is from ₱3 to ₱8 depending on condition and size. At present no pains are taken to have the market turkeys fed and properly fattened for table use.

The best time to fatten the young turkeys for the market is when they are about eight months old. They need not be penned. All that is necessary is to feed them three times a day in increasing amounts until they are fed all that they will consume of equal parts of corn, palay, and, if available, sorghum and Bukidnon adlay. One month feeding this way should put them in condition for the market. They will be easier to sell and surely would sell at better prices if fattened than if not.

Turkeys may also be caponized like chickens. They become quieter in disposition and less liable to range to distant places. In 1921 three seven-months old male turkeys were caponized at the Alabang Stock Farm to determine if there would be more improvement with regard to weight. The result after 1½ months showed only a small difference in favor of those caponized. All three at the beginning of the experiment weighed 15.5 kilograms and at the end they weighed 21 kilograms a difference of 5.5 kilograms.

Experiences at the Alabang Stock Farm show that the best hatching months for turkeys are during December and January. This will mean that poults hatched at this period would be over ten months old for the Thanksgiving and the Christmas holidays.

DISEASES AND PESTS

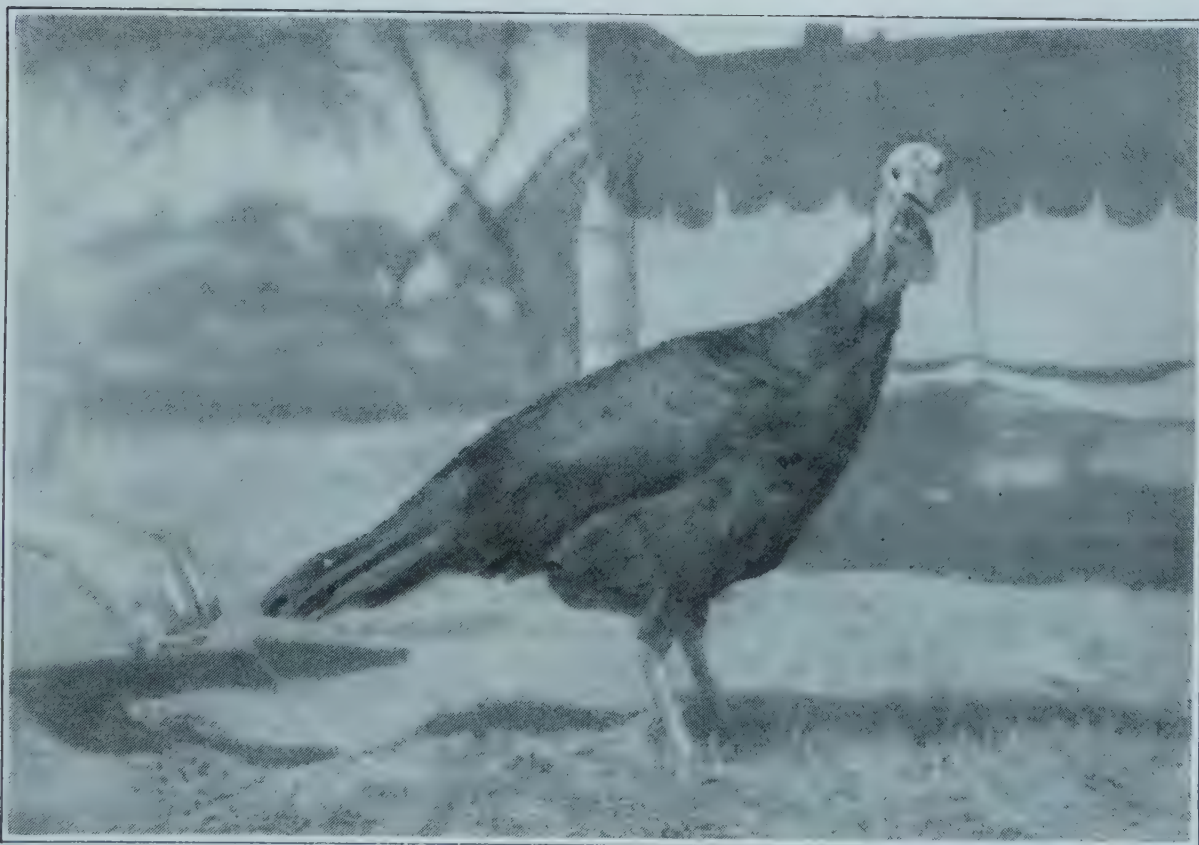
Turkeys are subject to practically the same diseases as chickens and reference may be made to our Circular No. 94, regarding them. However, mention will be made here of the most common ailments affecting turkeys.

White diarrhea.—This disease is caused by a germ called *Bacterium pullorum* that is transmitted from one poult to another through food and water and even by the mother through her ovaries if she happens to be infected. The poults die at the age of one to three weeks.

Treatment.—There is no reliable cure for this disease so prevention is the best remedy. Be sure that your grounds and fowls do not have it. If the poults have it, disinfect daily the premises where they are, using a strong solution of any disinfectant. Disinfect also the water and feed troughs before every feeding. Add a little potassium permanganate to the water to color it pink and feed the turkeys only cooked rice with chopped hard boiled eggs and a little black pepper.

According to some authors keeping a constant supply of some fresh sour milk is a good food to give to poults. This may be tried by those who can have milk without much expense.

Chicken pox ("Bulutong"—Tagalog name).—Chicken pox



A native turkey hen

attacks poults usually at the age of one to three months, is very contagious and causes death among them. The poults become full of red and later black nodules in the head and also the body.

Treatment.—The treatment that has been found best to help in curing this disease is by painting every chicken-pox nodule with tincture of iodine every night. At Alabang Stock Farm when chicken-pox appears the treatment is to dip a stick with cotton into clean water and then with the moist end pick one or two crystals of potassium permanganate. This is applied directly on the nodules with success. Separation of the sick ones from the healthy ones should be done at once to prevent the spread of the disease in the flock.

Enterohepatitis (known as "peste").—This disease is the most injurious to turkeys especially to adults or nearly mature ones. In the United States, it is commonly known as blackhead for in the course of the disease the head often becomes dark blue or nearly black.

The cause of the disease seems to be a parasitic protozoan (*Amoeba meleagris*) that leaves the body of the sick bird with the discharges of the alimentary tract and thus infects other turkeys. Diarrhea is nearly always a constant symptom. The ceca of the dead are inflamed and the liver large, showing necrotic yellowish-green areas.

Prevention is the best cure. Frequent disinfection of the houses, yards and the feeding and water troughs and destruction by fire of the sick and dead birds are necessary. Confine the turkeys in a small inclosure. Add some potassium permanganate into their drinking water to color it pink. Feed them only with a mash feed or better warm cooked rice and add to this, Abbot's sulpho-carbolate compound, a tablet to every four adult birds.

Do not keep turkeys and chickens together in the same yard as chickens have been found to be carriers of the blackhead organism without themselves being affected by it.

Pneumonia.—This disease of the respiratory system occurs frequently soon after a heavy rain during the hot days of July and August. The affected ones breathe rapidly, look dejected are not inclined to move about. There is profuse thick salivation that makes breathing difficult.

Prevention.—Putting the affected birds in dark warm but well ventilated boxes and cleaning the mouth with cotton to remove the thick saliva will sometimes save those that are not seriously affected. Feed small balls of warm cooked rice until recovery.

Lice and mites ("kutú" and "hanip"—Tagalog names).—Lice live upon the feathers, epidermis and secretion of the body of the host. Their eggs or nits are laid on the barbs of the feathers. They irritate and make the poults uncomfortable.

The mite sucks the blood of its host usually at night and lives in the cracks and crevices of the nests and perches where they lay their eggs and multiply. The chief danger from these pests is after the turkey eggs are hatched.

Prevention.—Dust the hen with insect powder twice a week during the incubation period. To the poults affected, rub a little lard upon the head, throat and under the wings. See that the nests and nesting materials are perfectly free from any lice and mites at the start of the hatch and during incubation. Make sure that the brood coop is also free from them. Use pure kerosene to paint the cracks and crevices in the brood coop as this will destroy the mites and even the eggs of these animals.

A cheap lice powder as that used at Alabang Stock Farm, Rizal may be prepared as follows: Take 3 parts gasoline or kerosene, and 1 part pure carbolic acid or creoline—mix together and add to it enough plaster of Paris to take up all the moisture. Powder the birds under the wings, in the fluff around the vent and on the ventral side of the body. When not in use the powder should be placed in well closed containers.

Ants and their prevention.—Ants are known to cause death of many poults especially when less than a week old. The best remedy is to keep the premises clean and not to allow food particles to remain long on the boards or feed troughs. The ants' nests should be destroyed when found.

ACKNOWLEDGEMENT

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AGRONOMICAL EXPERIMENTS PERFORMED BY THE PLANT INDUSTRY DIVISION, BUREAU OF AGRICULTURE, DURING 1923

LOWLAND RICE

Special variety test.—The multiplication test was carried on at Alabang, to raise seed material for the Bureau coöperators, and to enable the station concerned to judge the merits of the choice varieties when planted in a more or less commercial way. Sixty varieties were planted for this purpose.

A partial list of these varieties is presented below, merely to show their relations, the yields being in all cases below normal.

Variety name	Yield in kilos per hectare
Quinatia I	2,369
Lamio	1,774
Biñan	1,719
Mancasar	1,684
Inosema	1,572
Macan Lamio	1,565
Bad-as	1,364
Barangbang	1,200
Manabun-ac	1,051
Macan Santa Rosa.....	1,045
Piniling Daniel.....	1,030
Siamese "A"	1,011
Inachupal I	980
Minalabon	1,163

Irrigation experiments: submergence test.—Irrigation experiments carried on during the last three seasons (1923) at Alabang River Station, were directed mainly on the determination of the total amount of irrigation and rain water necessary to mature a normal rice crop. This amount, according to the results, is equivalent to a discharge of water ranging from 1.1 to 1.5 second liters per hectare throughout the submergence period. The experiments were conducted on a flat, closely-diked, old paddy land underlaid with an impervious substratum, and the distribution of water thereon was under perfect control. Initial

flooding was given to raise the water level up to a height of 5 centimeters and the subsequent submergence water had been kept within that height.

The work herein recorded was primarily an attempt at studying the means by which a future method of experimenting may be devised. In a series of six plots various depths of submergence were tried; that is in Plot No. 1 water was supplied to keep the soil just wet or saturated, as can be possibly done; in Plot No. 2 the submergence depth was marked at 5 centimeters; in Plot No. 3, at 10 centimeters; in Plot No. 4 at 15 centimeters; in Plot No. 5, at 20 centimeters; and in Plot No. 6, the supply was fluctuating.

Each of these plots contained a planting area of one are, 10 meters square, bounded by a single dike, measuring 25 to 30 centimeters wide at the base and 30 to 40 centimeters high. The whole system was connected on the more elevated situation, with the irrigation canal, and a drainage ditch on the opposite side.

Conner rice was planted in the plots August 14, 1923. At that time the seedlings were 50 days old. They were planted in hills containing 3 to 7 plants each, spacing the hills approximately 20 centimeters each way.

The plots were allowed to remain in the mud state until August 21, when a trial submergence in plots 2, 3, 4, 5 and 6 was started. Adjustment of the water was next made and in the afternoon of August 24 the first readings were recorded. Two readings had been taken daily, that is, one at 2. p. m. and the other at 6 a. m. on the next day, the two being considered as pertaining to the first day.

The period over which the submergence had been carried on, extended from August 24, 1923, the date of the first reading to November 4, inclusive or 73 days. At this time the plant was in dough stage, as Conner is an early maturing variety. All surface water was drawn out from every one of the submerged plots. Where water had stood deep as in Plots 3, 4 and 5, the resulting mud-ground was much softer, thinner, like a muck, as compared with other plots submerged to lesser depths, and this fact has given rise to a relative difference in the drying capacity of the plot beds as well as the maturity and lodging of the resulting crops.

The following tables show the depths of water applied, or submergence depths from consolidated morning and afternoon readings, which ran fairly uniform.

Table showing the average of 73 readings for each of the series, or the readings taken throughout the extent of the experiment

Plot Number	2 p. m.	6 a. m.
	<i>Cm.</i>	<i>Cm.</i>
1.	0.4	0.4
2.	5.7	5.7
3.	10.6	10.6
4.	15.4	15.2
5.	20.0	19.2

It is thus seen that with exception of Plot 5 no difference resulted between the 2 o'clock readings and the 6 o'clock readings. The lower water height registered for Plot 5 as observed at 6 o'clock was due in a great measure to the difficulty of controlling the water in that plot.

Just about two weeks from the first flooding, September 10, 1923, the young plants were attacked by the rice case worm, *Nymphula depunctalis*. The insect cuts off a good portion of the blades and spends its pupal stage in rolled up portions of the blade. The damage was most severe in Plot 5, where water was flooded 20 centimeters deep, Plot 4 was attacked badly enough though not so severe as Plot 5. In Plots 2 and 3, where submergence water was shallower, the injury by the insect was relatively slight. The condition of Plot 1, kept under moist or thin sheet of water, might well pass as normal. The severity of the insect attack increased for some time and at such a rate that on September 18, all plants in Plot 5 and a good percentage of those in Plot 4, were completely defoliated. Changing the water did not help the situation. The attack was made in the form of an outbreak, and the fact that it was particularly intense on the deeply submerged plots leads one to believe that the activity of the insect was associated with the depth of water.

There was no way of ascertaining the extent of the damage done, consequently the yields of plots given below are not to be considered relative and consistent experimental data. The maximum damage was about 27 per cent, when it is assumed that yield of Plot 1, to be normal or nearly so, and the difference between this yield of Plot 1, and that of Plot 5, which is 370 kilos to the hectare, to be the loss.

Hectare yields were directly computed from actual plot yields.

Plot number	Submergence depth		Yield per hectare
	cm.		kilos
1.....	Just	moist.	1,750
2.....		5	1,100
3.....		10	1,200
4.....		15	1,120
5.....		20	400
6.....	Fluctuating.		980

Plot 1 which was only moist, was overrun by the common rice weeds, largely by *Eleocharis capitata* and *Cyperus difformis*. It was thus necessary to weed this plot out. A thinner stand of weeds was also evident in Plot 2, 5-centimeter depth of water, and some hand cleaning was given. These weeds, however, were not noticeable in the deeply submerged Plots Nos. 4 and 5, which indicate that deep submergence of 15 to 20 centimeters was effective in controlling that class of weeds.

The deep submergence in Plots 4 and 5 had caused the maturing period to proceed slowly, as a result of the wet conditions of the ground obtaining for over a week after the water was withdrawn from the plots. Plot 1 matured November 15, exactly 179 days counting from the date the seed was set to sprout, whereas Plot 5 matured November 23, or 8 days longer. This relationship was also noticed in other plots. In Plots 4 and 5 the plant fell down to the ground, which was not the case in Plots 1 and 2 and in Plot 6.

Dry season crops—palagad.—The planting was done in February 1923 of six varieties, each occupying an area of about 200 square meters, at Alabang. As in the last two years, Sipot has again occupied the first place in production, with Mangasa and Dinagat taking the second and third places, respectively. The results from Rosales show Sipot also in the lead, then come, Binicol and Sanglay Puti. Saigorot and Lampadan are the two most promising representatives of the bearded class to do well in dry season planting.

The table of yields and the maturing periods follows:

Variety name	Maturing period in days		Yield per hectare in kilos	
	Alabang	Rosales	Alabang	Rosales
Sipot.....	140	137	2,221	3,094
Mangasa.....	145	128	1,983	1,400
Dinagat.....	140	123	1,401	1,095
Binicol.....	165	.....	1,195	1,958
Magsanglay.....	135	130	1,078	1,431
Lava.....	140	133	919	1,887

The Kaawa, Inita, and Lampadan, grown in Rosales alone, produced also a very good crop. Possessing an awned grain, the Lampadan variety is looked for to be the most adapted where protection from the birds is a necessity.

It is very probable that Binicol, a popular table rice would do better if planted broadcast so as to remedy its defect of producing uneven stand.

Coöperative Fertilizer Experiments; Experiment No. 1.—The field was planted to “Magasawang palay” on August 16, just after the fertilizers were applied as top dressing and harrowed in lightly. The seedlings at the time of transplanting were 50 days old. The field was only slightly weeded, for the weed growth was thin; irrigated only by rain.

The yields of paddies computed to one hectare, follows:

Plot No.	Fertilizer	Application per hectare	Yield of crop per hectare
		Kilos	Kilos
N.....	Ammonium sulphate.....	20 N	1,249
P.....	Acid phosphate.....	10 P ₂ O ₅	780
K.....	Potash salt.....	15 K ₂ O	908
CaO.....	Lime.....	500 Cao	826
Chk.....	Check.....		811
NP.....	Ammonium sulphate.....	20 N	
	Acid phosphate.....	10 P ₂ O ₅	1,143
Nk.....	Ammonium sulphate.....	20 N	
	Potash salt.....	15 K ₂ O	1,005
PK.....	Acid phosphate.....	10 P ₂ O ₅	
	Potash salt.....	15 K ₂ O	851
NPK.....	Ammonium sulphate.....	20 N	
	Acid phosphate.....	10 P ₂ O ₅	1,143
	Potash salt.....	15 K ₂ O	

^a Yield reduced by disease. ^b Slightly affected by disease. ^c Average yield of four plots.

Increased yields were obtained in all plots which received ammonium sulphate, alone or in combination with other fertilizers. The increase amounted to 324 kilos on average, and was equivalent to 40 per cent of the check crop.

An estimate of the profit which would accrue if ammonium sulphate were to be used on one hectare of rice crop is here submitted.

The market value of 324 kilos or 7.43 cavans of palay gained by fertilization, at ₱4 per cavan.....	₱29.72
Cost of 100 kilos ammonium sulphate, for 1 Ha.....	₱9.50
Freight charges and cost of applying.....	3.00
Total expenses	12.50
Gain	17.22

Coöperative Experiment No. 2.—The test was carried in two separate fields at Alabang, herein designated, as Field No. 1 and Field No. 2. Both lands were rated third or fourth class

with respects to productivity, and depend on rainfall for water supply. Field No. 1 was planted August 13, 1923 to Macan rice, the seedlings being about 50 days old. The crop was harvested Decemeber 21. Toward the close of September the plant presented stunted apperance: arrested growth and paling of the leaves' color. Search for insects had failed, and the condition was attributed to physiological disturbance in the soil. The disease appeared in more or less severe form in the two fertilized plots, although during the course of one month or so the plant seemed to have been able to recover normal color and the general condition looked better than the two nonfertilized plots.

Field No. 2 was planted on August 5, with Macan seedlings 41 days old in the seed bed. The crop was cut December 31, 1923.

The fertilizers were spread just before the last harrowing was given preparatory to planting.

The following table shows the results of the nitrogen fertilizers tests:

Fertilizer	Yields per hectare in kilos	
	Field No. 1	Field No. 2
Copra meal.....	1,231	426
Cattle dung.....	856	340
Check.....	748	371

In Field No. 1 copra meal has produced an increase of 483 kilos of palay over the non-fertilized plots. This increase is equal to 64.3 per cent. Cattle dung made, likewise a surplus yield over the check plots, of 108 kilos of palay, equivalent to 14.3 per cent.

In Field No. 2 the gain obtained with copra meal amounted to 55 kilos per hectare, which is equal to 14.8 per cent. In the case of cattle dung, however, the crop obtained fell below that of the check, by 31 kilos, little over 8 per cent.

Thus it follows, that in both tests copra meal made an increased yield, considerable in one, almost insignificant in the other from which no definite conclusion can be drawn.

At least in the first year of experimentation the dung may be supposed to be without effects on the rice crop, according to the results.

Experiment No. 3.—A third year experiment with a fertilizer mixture containing 3.3 per cent nitrogent 11 per cent phosphorous anhydride, and 4 per cent potash, was conducted in Rosales.

Rate of application per hectare	Yield per hectare in kilos		
	1922	1923	Average
100.....	925	1,902	1,413.5
300.....	2,346	1,930	2,138.0
500.....	2,140	1,732	1,936.0

PEDIGREE CULTURE

The first year culture was made of Masiksek rice, a native variety maturing in 195 days and Ryuchu, a well established variety from Formosa, maturing in 133 days and which is remarkable for its erect, non-lodging character.

Several of the pedigreed strains had been propagated. Four new varieties will be submitted to this test.

Drills versus broadcast planting.—This was a test on the efficiency of the two methods of planting upland rice—drill method and broadcasting. The seed used was Kinampupoy.

On one lot of ready ground, the seed was sown broadcast, and then plowed and harrowed in. On another lot of the same field it was drilled in rows 15 centimeters apart with a "Van Brunt" grain planter.

The yields per hectare are:

Drilled	1,137
Broadcasted	744

Hot-water seed treatment.—The hot-water (or Jensen) treatment on rice seed attacked with a fungus was tried. The seed used was that of Kathisod, a glutinous rice from Siam. Treated seed showed fungus growth during germination test, so was the crop grown from that seed.

Seed propagation.—The bulk of the propagation crop in Rosales was destroyed by the flood. At Alabang the yields had been much reduced by the unfavorable weather, characterized by drought followed by heavy rains.

Some 200 cavans of lowland rice seeds would be produced from both stations.

UPLAND RICE

The experiments on upland rice were performed at the Lamao Experiment Station. They were experiments devoted to finding superior varieties and to improving the most worthy of these by pedigree or line selection.

One hundred thirty-four upland varieties were planted in the regular test. Unfortunately, though, the floods which swept the station on November 18–19, 1923 had carried away the crops just before they could be harvested.

Of the pedigree culture all that was wanted for the continuation of the work, could be saved.

In the La Carlota Experiment Station at La Carlota, Occidental Negros over 36 hectares of land were planted to upland rice, and the crop is being disposed off largely as feed for the station stock, and the small better portion as seed for coöperators' planting.

CORN

LAMAO EXPERIMENT STATION

Variety test yields in dry season planting

Variety name	Computed yield per hectare		Shelling percentage
	Ears in kilos	Grains in cavan	
Moro.....	2,903.24	35.49	76.42
Calamba.....	3,534.28	46.44	82.14
Bohol.....	3,267.12	42.02	80.40
Cebu.....	3,250.49	41.86	80.27
Calipus.....	3,229.35	41.59	80.50
Kalaylay.....	2,327.08	29.82	80.08
Ferguson Yellow.....	2,188.93	25.56	82.14
Ferguson White.....	2,840.74	38.11	83.85
Cagayan.....	2,046.75	27.28	82.35
Check (Moro).....	2,843.75	34.77	76.42

Planted, October 24-26, 1922.

Harvested, February 5-11, 1923.

Area of unit plots, 432 square meters.

Variety test yields in wet season planting

Variety name	Computed yield per hectare		Shelling percentage
	Ears in kilos	Grains in cavan	
Moro.....	696.76	7.27	65.18
Cagayan.....	733.80	7.78	66.31
Kalaylay.....	856.48	9.72	70.97
Lobo.....	738.42	4.75	66.46
Ferguson White.....	446.92	4.45	62.88
Ferguson Yellow.....	296.29	3.00	69.72
Check IV (Moro).....	692.12	7.11	64.26
Baluga.....	733.80	8.42	69.00
Calipus.....	798.84	7.38	57.75
Calamba.....	1,013.88	11.70	72.16
Bohol.....	905.09	10.44	72.16
Cebu.....	592.59	6.08	64.18
Check (Moro).....	692.12	7.11	64.26

Planted, May 24, 1923.

Harvested, September 10-12, 1923.

Area of unit plots, 432 square meters.

Speaking generally, the growth during the dry season was vigorous, of even stand, and producing ears of large size. Calamba Yellow, Bohol, Cebu, and Calipus were the best yielders. The last two named varieties produced practically the same yields.

Poor yields were obtained from the wet season crop because the first planting, made on May 16, 1923, was attacked by locust,

and the second one herein reported was greatly damaged by the rains. Many of the plants produced no ears at all.

The Calamba, Bohol, and Kalaylay gave good yields. They had, together with the Ferguson varieties, given high proportions of shelled corn.

To check the results obtained from the dry season planting of 1922, a similar planting was done last October, but the experiment was destroyed by the flood, occasioning the loss of seven varieties.

Distance of planting test.—The experiment has been carried on in conjunction with the variety test during one rainy season and one dry season.

Yields in dry season planting

Variety name	Computed yield per hectare in kilos			
	1 × .70 m.	1 × .80 m.	1 × .90 m.	1 × 1 m.
Moro.....	3,250.00	2,851.85	3,194.44	2,879.63
Calamba.....	4,185.18	3,842.59	3,388.88	3,157.40
Bohol.....	3,333.33	3,148.14	3,504.63	3,393.51
Cebu.....	3,074.07	3,305.55	3,250.00	2,379.62
Calipus.....	3,444.44	3,430.55	3,212.96	3,018.51
Ferguson Yellow.....	2,175.92	2,259.25	2,148.14	2,231.48
Ferguson White.....	3,453.70	3,305.65	2,509.25	2,018.51
Cagayan.....	1,759.26	2,111.11	1,907.40	1,777.77
Check (Moro).....	3,275.00	2,782.40	2,761.11	2,555.55
Kalaylay.....	1,490.74	1,972.22	2,083.33	3,518.51

Yields in wet season planting

Variety name	Computed yield per hectare in kilos			
	1 × .70 m.	1 × .80 m.	1 × .90 m.	1 × 1 m.
Check I (Moro).....	481.48	407.40	731.48	500.00
Moro.....	351.85	400.74	601.85	542.59
Cagayan.....	611.11	527.77	805.55	638.88
Kalaylay.....	685.18	759.25	944.44	833.33
Check II (Moro).....	462.96	722.22	861.11	666.66
Lobo.....	712.96	790.74	842.59	546.29
Ferguson White.....	500.00	546.29	574.07	500.00
Ferguson Yellow.....	462.96	361.11	416.66	462.96
Check III (Moro).....	1,009.25	601.85	1,037.03	824.07
Check IV (Moro).....	685.18	759.25	935.18	435.18
Baluga.....	712.96	638.88	861.11	564.81
Calipus.....	555.55	712.96	692.96	573.98
Check V (Moro).....	731.48	812.96	879.62	712.96
Calamba.....	1,101.85	777.77	1,166.66	712.96
Bohol.....	777.77	861.11	1,000.00	953.70
Cebu.....	675.92	657.41	777.77	500.00
Check VI (Moro).....	777.77	666.66	1,083.33	759.25

Poor yields were obtained from the wet season test as the culture suffered from excessive rains and high winds throughout the growing period. Rats and wild hogs had also shared in the destruction.

With four out of nine varieties under the dry season planting, the yields increased with the decrease of space; four were indifferent with spacing; and one yielded in direct ratio to spacing.

Of the varieties planted for the wet season test, the best results were obtained from the 1 meter by .90 meter spacing. This distance gives ample space for the corn plants to properly develop, and allows room for cultivation.

Manifestly, if the crop is to be disposed of as animals' feeds, then close spacing of, say 1 meter by .70 meter should be adapted. For grain production, 1 by .90 meters would be preferable.

Another series of experiment was started with Calamba yellow corn in accordance with the following scale:

Distance	Plants per hill
1 m. × 30 cm.	1
1 m. × 50 cm.	1
1 m. × 70 cm.	2
1 m. × 90 cm.	2

The work is in progress.

Fertilizer test.—The test was confined to 6 plots only, each having an area of 264 square meters. Cagayan corn was planted in July, 1923.

The following table gives the kinds of fertilizer used, estimated cost of same, rates of application and results obtained, from the experiment.

Plot No.	Fertilizer	Compo- sition	Rate of ap- plication per hectare in kilos	Estimated cost ferti- lizer per hectare	Cost of production per hectare	Estimated yield per hectare in kilos
1	Check.	None.	None.		P72.72	91.66
2	{ Ammonium sulfate. Sulfate of potash. Acid phosphate.	{ N-3% K-1½% P-7%....	{ 150	{ P20.83	97.74	94.69
3	....do. ....	....do.	600	31.81	116.02	93.93
4	....do. ....	....do.	1,050	146.59	223.48	140.15
5	Mixture.	{ N-3% K-10% P-4% N-0.5	{ 400	{ 131.81	206.38	100.00
6	Cattle dung.	N-0.5	10,000	.....	80.29	197.00

Very poor results were obtained from this test because the culture was badly affected by rains. Much of the fertilizers was washed out. At tasseling, the plants were attacked by corn borers; and no ears were found in most of them.

Propagation.—The object is to propagate in a more or less extensive way the best varieties of corn for distribution to the farmers.

Below is a detailed account of the work.

Culture No.	Variety	Area planted in square meter	Cost of plant- ing per hectare	Yield per hectare in kilos	Number of days to ma- turity
1	Calamba.	860	97.21	910.46	94
2	Moro.	3,200	58.75	315.31	91
3	Cagayan.	3,000	59.33	619.33	87
4	Moro.	6,230	80.00	1,436.33	87

Cultures Nos. 1, 3, and 4 were planted on cañgin land. High initial cost of operations was occasioned by the clearing and difficulty encountered in planting the field.

SUGAR CANE

LA CARLOTA EXPERIMENT STATION

Variety test—plant cane.—There were grown in this test 16 varieties of sugar cane, including the Negros Purple, which was used as check. Each variety occupied 4 rows 150 meters long, the distance between the rows being 1.20 meters. The spacing between the plots was also 1.20 meters.

Planting was made December 8–15, 1922. A block measuring 66.7 square meters was harvested November 8–15, 1923 from each plot. Sample canes were submitted for analysis. The results are given in the table below.

Production in sugar and tonnage computed to one-hectare basis

Variety name	Yield of cane per hectare in tons	Yield of sugar per hectare in piculs	Tons of cane per ton of sugar	Piculs of sugar per ton of cane
Yellow Caledonia.....			8.84	1.79
New Guinea 24-B.....	87.604		6.23	2.54
Malabar.....	75.259	107.62	11.08	1.43
Louisiana striped.....	58.388	140.13	6.60	2.40
Java 247.....			8.25	1.92
Goru or New Guinea-24.....	88.110	183.26	7.61	2.08
Barbados.....	85.260		6.51	2.43
New Guinea 24-A.....			6.66	2.36
Rose bamboo.....	43.357	104.49	6.57	2.41
Luzon-1.....	62.795	156.98	6.33	2.50
Luzon-2.....	68.582	149.48	7.26	2.18
Luzon-3.....	60.687	118.94	8.08	1.96
Luzon-4.....	89.385	146.59	9.65	1.64
Big Tanna 3525.....	72.678	106.10	10.84	1.46
Badila.....	95.913	149.37	6.09	2.60
Negros Purple.....	75.915	113.59	7.94	2.04

Description of stools

Variety name	Number of stalks per stool	Length of stalks in meters	Average weight per stalk in kilos
Yellow Caledonia.....	3	2.05	2.25
New Guinea 24-B.....	3	1.83	1.36
Malabar.....	4	1.89	2.14
Louisiana Striped.....	4	1.88	1.71
Java 247.....	5	1.91	1.23
Guro or New Guinea-24.....	3	1.70	1.33
Barbados.....	2	1.71	1.22
New Guinea 24-A.....	3	2.05	1.31
Rose bamboo.....	3	1.73	.90
Luzon-1.....	4	1.45	1.03
Luzon-2.....	4	1.63	1.15
Luzon-3.....	5	1.68	1.03
Luzon-4.....	5	1.81	1.56
Big Tanna 3525.....	3	1.89	1.94
Badila.....	4	1.62	1.33
Negros Purple.....	4	1.47	.98

Analysis of the canes, 11 months old

Variety name	Juice				Bagasse		Cane	
	Cor- rected brix	Suc- crose	Approx. purity	Acidity n/10	Suc- crose	Fiber	Suc- crose	Fiber
		<i>P. ct.</i>			<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>
Yellow Caledonia.....	16.40	13.37	80.9	2.3	5.83	39	10.62	14.23
New Guinea 24-B.....	18.50	16.53	89.3	1.1	8.70	37	14.30	12.60
Malabar.....	15.33	11.61	75.8	3.3	3.74	31	8.64	11.76
Louisiana striped.....	17.10	15.56	91.7	2.4	5.51	33	12.25	10.82
Java-247.....	16.50	13.71	83.9	1.5	7.02	37	11.51	12.00
Goru.....	17.23	14.63	84.9	1.7	7.11	37	12.18	11.98
Barbados.....	18.33	16.28	89.0	1.4	8.12	39	13.48	13.33
New Guinea 24-A.....	17.63	15.71	89.1	1.4	8.63	37	12.99	13.98
Rose bamboo.....	17.70	15.90	89.9	1.6	5.47	35	12.15	12.67
Luzon-1.....	18.00	16.32	91.0	1.5	8.22	35	13.42	12.42
Luzon-2.....	16.81	14.73	88.0	1.3	8.42	35	10.40	12.69
Luzon-3.....	15.67	13.53	86.5	1.0	8.76	35	11.70	13.30
Luzon-4.....	13.87	11.61	84.1	1.2	8.37	37	10.70	10.88
Big Tanna 3525.....	15.67	11.88	76.1	2.3	6.43	42	10.20	12.69
Badila.....	19.47	17.35	89.0	1.6	11.07	37	15.99	7.95
Negros Purple.....	14.31	14.10	86.3	1.4	8.41	33	12.16	11.17

NOTE: The percentage extraction by hand mill ranges from 61.8 (New Guinea 24-a) to 78.5 (Badila). The average for Negros Purple is 66.5.

Java 247, Yellow Caledonia, New Guinea 24-A, Guro (New Guinea-24) and Badila gave very high tonnage yields. New Guinea 24-A, New Guinea 24-B, Barbados and Java 247 gave high sugar production. The results on commercial basis will be submitted in due time.

Variety test—first year ratoon.—Of the 16 varieties ratooned, the Goru ranked first among the first year ratoon crops, Yellow Caledonia second, and Java 247, third. In sugar production, however, Barbados leads the list, with Java 247, Yellow Caledonia, and Luzon 2 coming in order.

The crops were ratooned January 9, and the canes were harvested November 9–15, 1923.

The yields in the following table are computed from 15-square meter plots.

Production in tonnage and sugar computed to one-hectare

Variety name	Yield of cane per hectare in tones	Yield of sugar per hec- tare in piculs	Tons of cane per ton of sugar	Piculs of sugar per ton of cane
Badila.....	38.42	91.82	6.62	2.39
Barbados.....	68.36	.....	3.44	2.91
Big Tanna 3525.....	68.42	101.26	10.70	1.48
Goru.....	84.57	122.62	10.92	1.45
Java 247.....	73.28	161.95	7.16	2.21
Luzon-1.....	55.28	140.41	6.23	2.54
Luzon-2.....	65.37	143.59	7.23	2.19
Luzon-3.....	49.50	123.25	6.36	2.49
Luzon-4.....	46.28	108.29	6.77	2.34
Malabar.....	68.35	112.09	9.65	1.64
Negros Purple.....	50.28	120.67	6.60	2.40
New Guinea 24-A.....	43.00	88.15	7.72	2.05
New Guinea 24-B.....	47.28	99.76	7.50	2.11
Rose bamboo.....	45.28	104.59	6.85	2.31
Yellow Caledonia.....	80.70	157.38	8.12	1.95
Louisiana striped.....	57.71	115.97	7.88	2.01

Description of stools

Variety name	Number of stalks per stool	Length of stools in meters	Weight per stalk in kilos
Badila.....	4	1.30	1.05
Barbados.....	4	1.40	1.33
Big Tanna 3525.....	4	1.52	1.95
Goru.....	4	1.51	1.47
Java 247.....	6	1.29	.95
Luzon-1.....	4	.93	.82
Luzon-2.....	3	1.00	.93
Luzon-3.....	5	1.17	.77
Luzon-4.....	5	1.14	.72
Malabar.....	4	1.39	1.33
Negros Purple.....	5	1.16	.78
New Guinea 24-A.....	6	1.76	1.04
New Guinea 24-B.....	4	1.12	1.38
Rose bamboo.....	6	1.14	.71
Yellow Caledonia.....	4	1.62	1.98
Louisiana striped.....	4	1.41	1.16

Analysis of canes, 10 months old

Variety name	Juice				Bagasse		Cane	
	Cor-rected brix	Suc-crose	Aprox. purity	Acidity n/10	Suc-crose	Fiber	Suc-crose	Fiber
		P. ct.			P. ct.	P. ct.	P. ct.	P. ct.
Badila.....	18.5	16.21	87.6	2.1	7.62	26.5	13.29	10.81
Barbados.....	15.6	14.64	93.8	3.6	6.13	19.0	11.45	14.58
Big Tanna 3525.....	15.0	11.66	77.7	3.7	5.93	35.5	9.53	13.10
Goru.....	18.5	13.14	71.0	2.9	6.30	37.0	10.70	13.70
Java 247.....	17.4	15.17	87.1	3.1	6.16	36.0	11.52	14.50
Luzon-1.....	18.1	16.56	91.4	2.4	9.38	35.0	13.15	11.69
Luzon-2.....	16.43	14.64	89.1	2.0	7.70	34.6	12.32	12.60
Luzon-3.....	17.13	15.90	92.8	1.7	7.09	32.5	12.48	12.60
Luzon-4.....	16.47	15.15	91.9	1.6	9.98	39.0	13.27	14.15
Malabar.....	15.90	12.59	79.2	5.0	7.10	31.3	10.24	13.30
Negros Purple.....	17.57	15.87	90.3	2.8	10.12	38.3	13.78	13.80
New Guinea 24-A.....	15.93	13.98	87.7	2.4	7.79	36.0	11.49	14.40
New Guinea 24-B.....	17.17	14.73	85.7	3.2	6.89	37.0	11.81	13.78
Rose bamboo.....	16.93	15.27	90.1	2.8	8.20	35.0	12.89	11.86
Yellow Caledonia.....	16.03	13.69	85.4	4.9	6.11	39.0	10.67	15.52
Louisiana striped.....	16.00	13.88	86.7	1.8	8.15	34.3	11.59	7.61

NOTE.—The percentage of extraction by hand mill ranges from 57.5 (New Guinea 24-A) to 77.8 (Louisiana Striped).
Results in commercial basis to be submitted later.

Fertilizer experiment.—Negros Purple cane was planted in the first week of December, 1923, in two series of plots. Hills were distanced one meter apart from row to row and 40 centimeters in the rows. Plots measured 50 meters long and 10 meters wide each and were separated by strips 1.5 meters wide.

Fertilizers were applied on May 9, 1923, approximately 5 months from the date the cane was planted. The following table shows the kinds and compositions of the fertilizers and rates of applications used. The figures on tonnage and sugar yields being of sample cuttings only do not represent the final yields, which will be submitted after the crops of the entire canes have been milled.

Kind of fertilizer	Composition			Rate of application per hectare	Average yield of cane per hectare in tons	Average yield of sugar per hectare in piculs	Succrose in cane. Average analysis
	%N	%P ₂ O ₅	%K ₂ O				
Ammonium sulphate.....	20			200	109.9	147.7	<i>Per cent</i> 9.64
Treble superphosphate.....		47		520			12.49
Potassium sulphate.....			20	150	166.5	170.2	11.81
Lime.....				500	105.8	183.5	10.54
Ammonium sulphate.....	20	47		720			12.58
Treble superphosphate.....							
Ammonium sulphate.....	20		20	350	162.0	143.6	10.24
Potassium sulphate.....		47	20	670	95.0		11.09
Treble superphosphate.....							
Ammonium sulphate.....	20	47	20	870	97.2	150.2	9.72
Potassium sulphate.....							
Treble superphosphate.....							
Ammonium sulphate.....	20	47	20	1,370	87.0	125.3	9.40
Potassium sulphate.....							
Treble superphosphate.....							
Lime.....					90.0		12.40
Control.....							

Distance of planting test.—The results so far were not so marked with respect to yields as those of last year's experiment, but it was again evident that close spacing, 80 centimeters by 10 centimeters, for instance, gives a higher net production of cane and sugar than the open planting, 1.20 centimeters by 40 centimeters; and this relation appears to be fairly well kept up for every graduation of spacing.

The ability of Badila plant to maintain an erect position, as compared to Negros Purple, is a distinct advantage from agronomic view point.

Mosaic disease experiment.—The mosaic and non-mosaic Negros Purple cuttings were planted on December 28, 1922. On February 26, 1923, hills were examined for the number of dead and number of living hills. Another counting was made on October 31, 1923.

Number of mosaic and healthy hills and death rates

Plot No.	February counting—numbers						October counting—numbers					
	Mosaic			Healthy			Mosaic			Healthy		
	Living hills	Dead hills	Death rate	Living hills	Dead hills	Death rate	Living hills	Dead hills	Death rate	Living hills	Dead hills	Death rate
1.....	688	352	<i>P. ct.</i>				642	46	<i>P. ct.</i>			
2.....				744	296					702	42	
3.....	514	526	41.9	664	376	36.6	514	0	3.9	642	22	3.2
4.....	611	429		569	471		586	25		569	0	
5.....												
6.....												
Total...	1,813	1,307	41.9	1,977	1,143	36.6	1,742	71	3.9	1,913	64	3.2

The following tables give the average measurements taken with the cane stools of the mosaic and healthy plants, the percentage of sugar contained in the cane, etc.

Plot No.	Seed cane	Number of stalks per stool	Weight per stalks	Length of stalks	Diameter of stalks
			Kilos	Meter	Cm.
1.....	Mosaic.....	3.6	1.26	1.18	7.9
3.....					
5.....					
2.....	Healthy.....	5.4	1.30	1.31	8.3
4.....					
6.....					

Analysis

Plot No.	Seed cane	Sucrose in cane	Tons of cane per ton of sugar	Piculs of sugar per ton of cane
		Per cent		
1.....	Mosaic.....	12.91	7.17	2.21
3.....				
5.....				
2.....	Healthy.....	13.65	6.54	2.42
4.....				
6.....				

Acclimatization test.—Several new varieties were introduced in Lamao. The more promising varieties and strains are the H-109 seedling, Barbados Striped, New Guinea-40 sport, H-27 seedling, Inalmon No. 2-Pl, Inalmon No. 1-Pl, Malagache and Tapol. The “C. A. C” strains from the College of Agriculture, University of the Philippines, are adapted to local conditions.

Experiment on large versus small sized points.—The experiment involved the planting of 25,000 points (Negros Purple) with the aim to find out if there was any advantage to be gained in selecting large-sized points with well developed “eyes” for planting. Accordingly, the points were sorted and grouped into large-sized points and small-sized points. A third lot was made up of mixed sizes.

The crop was still in the field when the report was being written, yet to judge from the results of measurements there would be little or no difference since the selection was not based on individuality of plants.

[Average figures]

Points	Number of stalks per stool	Height of stalks	Diameter of stalks	Length of internode
		Meter	Cm.	Cm.
Big sized.....	7	1.16	2.60	8.15
Small sized.....	7	1.15	2.58	8.09
Mixed sizes.....	7	1.20	2.58	8.09

Seedling cane production.—Larger collection of seeds has been obtained this year, from a number of leading varieties of sugar cane at La Carlota and Alabang.

At La Carlota the Inalmon and Hawaii 109 seedling canes, which were grown from seed in 1921 are still under observation. Of the 1922 stock, there have been just recently planted in the nursery two selected stools of Java 247 and one stool of Formosa variety. The seedling plants of Otomato did not survive at La Carlota. Inferior individuals have been discarded. In Alabang Rice Station ratoon plants of Badila seedlings were allowed to grow. One of these has produced a large number of fine stalks. Cuttings of same have been set out in the field.

Growing of sugar cane for seed—costs of production.—The La Carlota Experiment Station has made an estimate of the expenses incurred in connection with the raising of sugar cane on 4 hectares, and gives the cost of production per hectare as follows:

Items	Expenses
Preparation of land.....	P120.00
Planting (including value of seed cane).....	52.00
Cultivating.....	130.00
Harvesting and hauling.....	138.00
Total.....	440.00

TOBACCO

DAMMAO TOBACCO STATION

The activities of the Dammao Tobacco Station at Gamu, Isabela during the year have been principally the further testing of promising native varieties and strains and the acclimatization of equally or more promising foreign varieties. The former were on the whole, bred for high yield and the latter for wrapper suitability. Two hectares were employed for the tests. It is expected that barring adverse conditions during the tobacco season, at least 30 fardos of wrappers, 30 fardos of binders, and 140 fardos of fillers will be raised incidentally from all the experimental cultures.

Seed beds.—Because originally it was intended to supply pedigreed seedlings to all the coöperators of the station, 2 hectares of seed beds were prepared and sown but these were destroyed only by the record November flood. However, the other seeds in stock were sown immediately on seed beds covering an area of one hectare. The good germination of these insured a suffi-

cient supply of seedlings for the cultures during the ensuing tobacco season, for which at least 40,000 seedlings will be required.

Vitality tests of seeds.—This experiment was incidentally carried out in connection with the open beds and the germinating boxes of all the seeds of the different varieties and strains used in the variety and propagation tests conducted by the station. Three important points were observed. First, under the same conditions, different varieties and strains of tobacco exhibit different degrees of viability, ranging from 65 per cent to 95 per cent for fresh seeds and from 10 per cent to 50 per cent for one-year old seeds. Vigorous strains of 11 Espada Dammao and 12 Dammao Broadleaf showed as high a germination as 80 per cent when the seeds are stored in well-sealed paper packages kept in Mason fruit jars. Experience with these jars shows though that the viability of seeds stored in them falls after one year, to about 50 per cent. Second: A very high germination percentage is obtained under controlled conditions as in the case of germinating boxes which could be kept safely in a shed. Irregularity in weather conditions in the Cagayan Valley is responsible for irregular germination percentages for the same strain or variety in different seasons. Third: Provided germination is well controlled, ten mother plants can easily supply seedlings to plant two hectares of tobacco land. In this year's seed beds an individual plant of 18 Florida Sumatra produced at least 3,000 fine healthy seedlings.

Acclimatization tests.—The foreign varieties 18-Florida Sumatra, 358-Sumatra, 1-Connecticut Havana, 28-Havana, 25-Dumbara and 36-Bahis were used. Of these varieties only the 18-Florida Sumatra showed normal performance although rather markedly susceptible to mosaic.

General variety test.—In addition to the six foreign varieties already referred to, ten native varieties were used in this experiment namely, 34-Anipa Sumatra, 53-Dammao Medium Hybrid (three types), 12-Dammao Broadleaf, 14-Dammao Medium Broadleaf, 11-Dammao Espada, 4-Palattao Broadleaf, 49-Cauayan, 10-Dammao Medium Repollo, 6-Anipa Broadleaf, and 51-Angadanan.

Four noteworthy points were observed in this experiment. First: The native variety as a whole showed the best vegetative performance whereas the foreign varieties with the exception of the 18-Florida Sumatra, were deficient in some way or other. Second: 12-Dammao Broadleaf showed the greatest number of standard leaves (26 as well as by a very high breadth index

[47 per cent] for a typical filler strain) Third: 11-Dammao Espada proved itself to be the most prolific grower but unfortunately possessed the lowest breadth index (39 per cent). Fourth: 6-Anipa Broadleaf showed itself to be a great possibility by surpassing by 1 per cent the breadth index of 12-Dammao Broadleaf although it had 3 less leaves.

Effect of spacing on planting.—The varieties 18-Florida Sumatra, 12-Dammao Broadleaf, 14-Dammao Medium Broadleaf, 54-Anipa Sumatra and 58-Dammao Medium Hybrid No. 1 were used in this experiment. Two distances were employed.

(a) 70 by 70 centimeters.

(b) 50 by 80 centimeters.

No favorable results were obtained in this experiment owing to the May showers which washed away the gum from the leaves and which incidentally made the leaves susceptible to all kinds of leaf spot diseases. A noticeable change in texture was, however, observed which warrants the repetition of this experiment.

Wrapper variety tests.—In this experiment, the varieties 53-Dammao Medium Hybrid No. 1, 54-Anipa Sumatra, 14-Dammao Medium Broadleaf, 11-Dammao Espada, 12-Dammao Broadleaf, 4-Palattao, 17-Pampano, 10-Medium Repollo, 49-Cauayan, 50-Echague and 1-Connecticut Havana were used. Shade was provided by a partially cleared young forest and by alternate rows of corn. In the first case the plants were set out 50 by 50 centimeters apart and in the second, 50 by 80 centimeters. The first method was quite successful especially in the case of the native 4-Pallattao. The second method was a failure as the plants were very much affected by mosaic.

Curing experiment.—This experiment was conducted in order to compare the Modified Native Method with certain foreign approved methods; namely, (1) Face-to-face and back-to-back, (2) Face-to-back, and (3) Cuban in which the leaves are pierced with twine so that they ride alternately on the poles. The controls were the native methods of (1) partially curing the leaves in the sun and afterwards hanging them up in the curing shed and (2) partial sun-drying and afterwards hanging them under the house.

Observations made during the experiment showed that all the methods tried with the exception of the two alternative native methods, were satisfactory. With the Cuban method the leaves are cured one day earlier but this difference is immaterial. The

method followed at the station is a sort of the modified native method. The leaves are strung side by side, folded in palillos capable of holding at least 50 leaves and allowing a finger-breadth between the leaves. The leaves are racked directly into the shed for complete shade and slow curing. This method showed as favorable results as the approved foreign method.

Preliminary histological studies.—These studies were incidentally started in an attempt to account for the so-called “quality” of wrapper leaves. The relatively well-developed cuticle of the Sumatra seems to be responsible for its ability to stand the stress to which it is subjected to in spite of its thinness which amounts almost to transparency. On the other hand its central parenchymatous cells appear to be very weak as they (cells) cannot be well defined when the leaf is cured and fermented. Curiously enough, these facts are reversed in the native Dammao Medium Broadleaf; that is, the latter has a relatively poor cuticle but a stronger central parenchyma.

Seed and seedling distribution.—There were distributed in all 19,470 seedlings representing seven different varieties and 51.62 kilos of seed of ten varieties.

PIKIT TOBACCO STATION

The work of the Pikit Tobacco Station has been in the main, the continued planting of the wrapper varieties, and the experiments for the acclimatization and improvement of same. The hectarage devoted to the crop increased from two hectares in the 1922–1923 season to 3 hectares during the ensuing season. The present crop, if conditions remain normal, may be expected to be about 1,000 kilos of wrapper tobacco and twice that quantity of binder and filler leaves.

Seed-beds.—Two nurseries were prepared. There were 94 seed-beds of moderate size. Over 100,000 seedlings were raised, pricked and distributed. Sowing was done in October.

Experiment on the intensive and extensive methods of planting.—The extra amount of care and consequent outlay per unit area with the modern way of planting is greater than in the case of the native method, but, it has been observed that there is a greater development and more uniform stand of the plants than by the former method, that may more than compensate for the extra work and expense. The experiment is being tried in four plots having 1,000 square meters each. The Florida Sumatra tobacco was used.

Seasonal planting.—Seasonal plantings at Pikit have been carried on through 2 sets of experiments; that is, the first set was planted in the months of April and May, for off season crops, and the second set was planted in September and October for regular season crops. In the first set the variety used was Baker Sumatra. The area planted was limited. In the second set, however, several varieties, all of the wrapper class, have been used. The September planting included the Baker's Sumatra, the two newly received S. P. No. 1 and S. P. No. 2, and Florida Sumatra; while the October planting has comprised all these varieties plus some hybrids. Greater hectarage has been employed with the two regular season plantings. The crops planted in April for trial during the off season was a failure on account of the seedlings have been attacked by insect borers during the seedling stage.

Better results were secured with the crop planted in May. While the growth was uneven as a result of different ages of seedlings transplanted. The production was large, and the percentage of wrapper was correspondingly so. The sowing of this crop was done on May 19 and the seedlings were transplanted beginning July 16, 1923. Harvest was begun on September 6th and continued up to October 20th. The leaves were classified into two groups; the wrapper class, and binder-filler class. The quantity of these 2 classes follows:

Variety	Area planted	Production		Per cent wrapper	Production per hectare		
		Wrap-pers	Binder and filler		Wrap-pers	Binders	Total
Baker's Sumatra.	Sq. m 100	Kilos 6.2	Kilos 7.8	Per cent 44.2	Kilos 618.8	Kilos 781.2	Kilos 1,400

The results indicate that the raising of the off season crops planted in May is more or less profitable. With regard to the regular season planting the first sowing was done in September and the second sowing in October. The crop planted in September has been considerably delayed in transplanting, and thus gave rise to the poor stand of the Florida Sumatra variety. However, this delay did not affect in anyway the Baker's Sumatra and the two S. P. varieties, all of which showed good growths. The harvest of these crops have been made in December.

Plant-to-the-row tests with hybrid plants.—Approximately 2,000 square meters of ground have been planted to several selections of the following hybrids.

Field No.	Parent plants	Station name	Row Nos.
A	Sumatra X Florida Sumatra.....	.....	1-20
B	Florida Sumatra X Sumatra.....	.....	21-40
C	Dammao Broadleaf X Sumatra.....	"Dammatra"...	41-50
D	Connecticut X Sumatra.....	"Connatra"....	51-56
E	Havana X Sumatra.....	"Havanatra"...	67-77

A test on distances of planting for these hybrids is underway. There are grown separate plots of B X hybrids. Hybrids show diversity of growth, vigor and character. Florida Sumatra hybrids show distinct improvement in the texture of leaves over the parent plants.

Tephrosia candida is being tried by the station as shade plant for tobacco. It was planted at the end of June in rows running North and South, and set 4½ meters apart. In the middle of November, four to five months afterwards, four rows of Florida Sumatra were planted in between the rows of *Tephrosia candida*, at a distance of 90 centimeters from one another; also five rows each of Baker's Sumatra, S. P. No. 1, S. P. No. 2, and B X Hybrid, at a distance of 80 centimeters from one another. The total area covered by this experiment is 7,830 square meters.

Variety and acclimatization tests.—Inasmuch as filler varieties, or at least most of them, do well in the Cotabato Valley there is no need of further experimenting with them. The station was specially interested in the wrapper varieties and has therefore set out Baker's Sumatra, S. P. No. 1, S. P. No. 2, and Florida Sumatra, in connection with the variety test.

S. P. No. 1 and S. P. No. 2 are new varieties of the Sumatra class. S. P. No. 1 resembles Baker's Sumatra in form and general appearance. S. P. No. 2 has wider and greener leaves than No. 1. Culture of the latter variety under the seasonal planting experiment indicates that it is quite susceptible to chlorosis.

The two new varieties and Sumatra American grown, Bohia, and 199 Hybrid Montgomery are growing in the acclimatization test plot.

Distances of planting with wrapper varieties.—Distances have been arranged to conform to plant types. Thus with Baker Sumatra, which is small leafed type the distances are:

- 90 centimeters by 50 centimeters.
- 90 centimeters by 40 centimeters.
- 80 centimeters by 40 centimeters.
- 50 centimeters by 50 centimeters.

With the broad-leafed Florida Sumatra wider spaces are provided:

- 100 centimeters by 50 centimeters.
- 100 centimeters by 40 centimeters.
- 80 centimeters by 50 centimeters.
- 90 centimeters by 40 centimeters.

FORAGE CROPS

Lamao Experiment Station.—Comparative test.

The following table gives the number of cuttings and aggregate yields obtained from each species.

Name of grass	Computed yield per hectare in kilos
Check I (Guinea).....	240,894
Napier.....	313,037
Guinea.....	184,439
Guatemala.....	143,746
Cayenne.....	32,265
Check II (Guinea).....	110,405
<i>Paspalum dilatatum</i>	111,998
Para.....	112,413
Bugalon.....	28,720
Check III (Guinea).....	111,080

Distance of planting test.—The distance of planting between the rows was 1 meter; the distance between the hills in the rows varied in this test, from 25 centimeters to 40, 55, 70, and 85 centimeters for each crop.

The following table shows the aggregate yields from cuttings made every 40 days.

Name of grass	Computed yields per hectare in kilos				
	1 × .25	1 × .40	1 × .55	1 × .70	1 × .85
Check I (Guinea)	8,660.00	7,885.71	7,240.00	6,720.00	5,597.14
Napier.....	15,515.15	13,851.51	11,000.00	10,848.48	10,336.66
Guinea.....	6,893.65	6,308.00	6,090.00	6,088.88	5,092.06
Guatemala.....	6,900.00	6,314.28	5,385.71	4,980.00	4,185.71
Cayenne.....	621.43	521.42	435.71	414.28	300.00
Check II (Guinea).....	3,898.18	3,918.09	3,316.36	3,403.63	2,909.02
<i>Paspalum dilatatum</i>	4,181.25	3,618.75	3,600.06	3,100.00	3,106.25
Para.....	3,073.32	2,706.66	2,720.00	2,360.00	2,253.33
Bugalon.....	446.66	446.66	413.33	413.33	353.33
Check III (Guinea).....	3,308.00	3,098.41	2,768.25	2,679.52	2,482.53

The yields increase as distances between the plants decrease. Best results were produced by the distance of 25 centimeters and 40 centimeters in the row.

New introduction.—This work has for its object the propagation of introduced plants found adapted to Philippine conditions.

The following table shows a list of the new forage plants and record of trials.

Name of plant	Source	Area planted	Date planted	Germination test	Adaptability	Remarks
		Sq. m.		Per cent		
Australian blue grass...	Hawaii.....	2.00	8-5-23	0	.....	Plants died.
Wonder forage.....	Hawaii.....	20.00	5-10-23	40	Fair.....	Included in forage yield test.
<i>Pennisetum setosum</i>....	.....do.....	20.00	5-10-23	45	...do.....	
Zacate blanca de Honduras.	Cuba.....	20.00	5-10-23	87	...do.....	
Exphorus unisetus.....	Hawaii.....	3.00	8- 5-23	60	Poor.....	Carried by flood.
<i>Pennisetum complanatum</i> .	Hawai.....	2.00	8- 5-23	0	.....
Juda.....	.....do.....	.90	8- 5-23	0	.....
Fussy top.....	.....do.....	2.00	8- 5-23	0	.....
Bayakibok.....	Santa Cruz, Laguna.	100.00	8-18-23	70	Promising	Growing luxuriantly in paddy soil.
Merket.....		130.00	8- 5-23	95	Good....	Growth, same as Napier.
<i>Pennisetum longistalum</i> .					Died.....	Plant received in dried condition.
<i>Panicum antidotali</i>		2.00	8- 5-23	0	.....

Yield and Feeding Tests of Grasses.—The following table shows the yields per cutting on one hectare basis.

Name of grass	Yields of grass when cut at—							
	20 days old	30 days old	40 days old	45 days old	50 days old	60 days old	75 days old	90 days old
	Yield (kilos)	Yield (kilos)	Yield (kilos)	Yield (kilos)	Yield (kilos)	Yield (kilos)	Yield (kilos)	Yield (kilos)
Check (Guinea).....	39,121	63,713	36,260	.....	33,180	68,420	.....	.....
Napier.....	64,807	97,392	65,414	39,474	74,045	111,379	62,834	40,000
Guinea.....	35,008	37,962	31,162	23,879	58,379	51,874	41,684	28,400
Guatemala.....	1,585	37,814	27,764	11,897	28,840	47,743	19,780	17,000
Cayenne.....	26,543	1,193	2,329	2,614	1,364	836	19,010	28,000
Check (Guinea).....	13,513	17,669	17,707	.....	20,171	41,845	.....	.....
<i>Paspalum dilatatum</i> ...	25,103	23,675	17,913	15,511	18,588	26,719	15,000	13,780
Para.....	27,140	29,453	13,180	9,460	13,480	29,160	18,404	16,530
Bugalon.....	11,260	11,200	2,073	871	2,147	2,040	8,687	14,980
Check (Guinea).....	14,510	23,026	14,606	.....	26,461	32,477	.....	.....
Uba cane.....				16,041	.....	.....	26,750	45,105

The following table gives the percentage of grass consumed by animals, per cutting.

Name of grass	Percentage of feed grass consumed by animals when cut at—							
	20 days old	30 days old	40 days old	45 days old	50 days old	60 days old	75 days old	90 days old
	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.
Check (Guinea).....	100	100	91	.....	65	69	.....	.....
Napier.....	100	86	78	74	59	37	48	41
Guinea.....	100	100	91	86	65	69	54	49
Guatemala.....	100	100	100	100	100	95	95	82
Cayenne.....	100	.....	.....	24	.....	33	21	15
Check (Guinea).....	100	100	91	.....	65	69	.....	.....
<i>Paspalum dilatatum</i> ...	100	100	100	92	90	73	79	65
Para.....	100	100	100	88	92	72	69	71
Bugalon.....	100	100	100	100	.....	.....	100	84
Check (Guinea).....	100	100	91	.....	65	69	.....	.....
Uba cane.....				98	.....	.....	95	85

In this feeding test bullocks were used. When the grass was cut at 20, 30, 40, and 45 days old, practically all parts of the plant were eaten clean by the animals. The leaves and stalks of the grasses cut after 45 days of growth had become hard and tough, and were not all relished by the animals.

The Cayenne grass becomes unpalatable as it advances in age and should be given to animals while yet young.

The leaves of *Paspalum dilatatum* and Para grasses were too dry for soiling, when the plants attained some degree of maturity.

In the case of Uba cane, Napier, Guinea, and Guatemala grasses, it is the stalks that were rejected by the animals when cuttings were made of old growth.

Cuttings of the Bugalon were all consumed regardless of the age of plant, which remained fresh and excellent throughout the year.

This experiment could give hints of the palatability alone, and would take several experiments to test on the net amounts consumed and food values as measured by increased weights of the animals fed.

Test of Sorghum, Ragi, Millet, and Adlay for forage.—To determine the value of these crops a trial plot was made during the year. Planting was made on July 6–7, 1923.

The following table gives the yields and percentage of feed consumed.

Name	Cut before flowering ¹	Cut at flowering ²	Computed yield per hectare in kilos		Per cent of feed consumed	
			Before flowering	At flowering	Before flowering	At flowering
	<i>Kilos</i>	<i>Kilos</i>				
Sorghum.....	97.0	117.0	20,208.33	24,541.66	55	35
Ragi.....	36.0	56.3	9,000.00	14,075.00	100	95
Millet (sanyo).....	15.5	28.4	3,875.00	7,100.00	100	80
Adlay.....	46.0	76.2	11,500.00	19,050.00	100	80

¹ On September 25, 81 days after date of planting.
² On November 28, 145 days after date of planting.

Sorghum gives most stuff, but its acceptability is low compared with other plants tried. Ragi, Millet, and Adlay were all consumed when given at flowering stage, 90 days from planting.

Propagation.—This work aims at multiplying suitable forage plants for distribution purposes.

The following table gives the names of grasses, area planted to each, etc.

Name	Date of planting	Area planted	Condition of growth
		<i>Sq. m.</i>	
Napier.....	6-10-23..	982.50	Excellent.
Guinea.....	.....do..	851.50	Do.
Uba cane.....	6-11-23..	327.50	Do.
Jaragua.....	.....do..	131.00	Poor.
Merker.....	.....do..	65.50	Excellent.
<i>Paspalum dilatatum</i>	6-12-23..	131.00	Good.
Bugalon.....	6-13-23..	65.50	Fair.
Molasses.....	.....do..	131.00	Very poor.
Guatemala.....	.....do..	131.00	Excellent.

At present there is at Lamao ample stock of Napier and Guinea grasses for distribution and a limited quantity of Uba cane, Merker, and Guatemala grasses.

The propagation of forage crops for distribution purposes is being done at Alabang Rice Station, aside from that of Lamao. At the Alabang Rice Station, manimanian, an uncultivated native leguminous plant is being domesticated. Wide cultivation of this grass as horse feed, specially, is to be encouraged.

The varieties of sorghum, Guinea grass, Guatemala, Merker, Napier, and Uba cane are being grown at Alabang on about three-fourth of a hectare in extent.

In La Carlota the Uba cane, Para grass, Guinea, and Napier are grown, mostly as feed for the work animals.

FIBER INVESTIGATIONS

GUINOBATAN ABACA TRIAL STATION

Experiments.—Very little was done as yet in the way of experiments. One experiment set up is included to find out the age and size with which an abaca sucker must be planted so as to give the best results. Another experiment was started with a view to measuring the value of mulching in the abaca plantation. There are two ways of preparing abaca strips in vogue locally known as “lucnet” and “bacnes,” and the station has committed itself to investigate which of the two is the more advantageous.

At Lamao Experiment Station—Maguey and sisal.—Small plots had been planted to maguey and sisal, for future seed stock. An experiment is in progress with these two plants, which would determine the right distance for planting them at Lamao.

Comparative yield test of agave sp., etc.—In this experiment are incorporated, the maguey, agave zapupe, Henequen, Sansevieria Zeylanica, B. Zulcata, and others. The size of the plots

vary with the number of seed plants there were available at the time of planting.

COTTON

Variety name	Computed yield per hec- tare in kilos	Remarks
Sea Island (Check).....		
New Baykin.....	130	
Ferguson.....	161	
Lone star.....	243	
Cambadra.....	150	
Sea Island (Check).....	74	
Kinastila.....		Not yet in bloom.
Carabonica.....		Soon to be harvested.
Toquello.....	14	
Cuban Brown.....		Not yet in bloom.
Sea Island (Check).....		

Cotton planted in the month of May, June, and July died from too much rain. This suggests that the planting time should be so arranged so as to avoid putting the seeds in water clogged soil and allow both to mature during the dry season of the year.

The highest percentage of germination with cotton was recorded from seed placed in dry sawdust, giving a viability of 38 per cent after a four month keeping. This was closely approached by seed kept in charcoal. Two months afterward, the seeds tested 10 per cent and 12 per cent, when kept with sawdust and charcoal, respectively, in air tight cans.

Roselle.—The Archer, Victor, and Rico are being propagated. One hundred plants of each of the White and Red-fiber roselle were harvested. The amount of fibers extracted is 1.8 kilos from the White-fiber variety and 1.4 kilos from the Red-fiber variety.

AT LA CARLOTA EXPERIMENT STATION

Abaca.—At the La Carlota Experiment Station the fiber project has been, with the exception of some minor experiments, reduced to the maintenance of the abaca fields, necessary to meet occasional demands for suckers and seeds. There were given away in 1923, 800 suckers and 3,500 grams of seeds of abaca representing 27 varieties. The plantation, despite of the little care the station was able to give it, has been in good condition. It was possible for the station to collect specimens and to perform experiment on the relative proportion of fiber contents therein. Comparison has been made of plants from suckers and those raised from seeds. It appears from the data obtained that seedling-plants gave on the average greater percentage of

fiber, than sucker-plants. There is also probability that seedling-plants are more resistant to heartrot disease than the plants grown from suckers, according to the results.

Miscellaneous fiber plants.—There are now at La Carlota a good number of Panama hat palm suckers that can be distributed. The stripping of the fibers and bleaching were attempted there with little success.

Jute, ramie, anabo, and tikog are the other fiber plants in Lamao, worth mentioning.

COMPARATIVE TESTS OF SIX PHILIPPINE CORN
VARIETIES

By FRANCISCO D. MARQUEZ, *Agronomist, Bureau of Agriculture*

The main object of the experiments discussed in this article is to determine the comparative yields of the varieties of native corn. It is intended to carry later extensive trials of the best one or two in the different places of the Islands.

The work covered a phase of the corn breeding work of the Bureau of Agriculture at the La Carlota Experiment Station, La Carlota, Occidental Negros. The experiments were conducted in 1919 to 1921.

MATERIALS AND METHODS

The varieties used in this work were Bohol White Flint, Cebu White Flint, Moro White Flint, Baluga Yellow Flint, Cagayan Yellow Flint, and Calamba Yellow Flint. These varieties were the most promising on hand at the time of the experiment. They were introduced into the station at different times and from different places as shown in Table No. 1.

TABLE No. 1

Variety name	Date received at station	Province where obtained
Bohol White Flint.....	Nov. 1, 1918....	Bohol.
Cebu White Flint.....	Aug. 1, 1918....	Cebu.
Moro White Flint.....	1915.....	Leyte.
Baluga Yellow Flint.....	Nov. 15, 1918....	Tarlac.
Cagayan Yellow Flint.....	April 26, 1916...	Cagayan.
Calamba Yellow Flint.....	March 3, 1916...	Laguna.

DESCRIPTION OF VARIETIES

Bohol White Flint (See Plate No. IV-a).—Ears, moderately cylindrical; size, medium; butts, slightly enlarged at shank, round, well filled; tips, blunt and generally exposed.

Kernels, 75 per cent of ear by weight; large, shallow on cob; length and width relatively equal; color, white, some pearly white with starchy caps; grains, flintly, well paired; rows of kernels, fairly straight and tight; typical number of rows, 14; germs, bright in color, large and cover a good length to the crown, grains easily shelled.

Cobs, medium in size, white in color.

Plants, medium in size; typical height, 2.4 m.; leaves, large and broad.

Cebu White Flint (See Plate No. IV-b).—Ears, slightly tapering, small; butts well shaped and nicely filled with grains; slightly enlarged at shank; tips blunt and exposed in general.

Kernels, small and deeply set on cob; longer than wide; color, pearly white with starchy caps; wedged shape, well paired; rows of kernels, fairly straight and close typical number of rows, 14; germs, bright in color, large and cover a good length to the crown; grains, easily shelled; 83 per cent of ear by weight.

Cobs, small and white. Plants, medium in size; typical height, 2.4 meters; have tendency to produce tillers and rudimentary ears.

Moro White Flint (See Plate No. V-a).—Ears, fairly cylindrical, large in size; butts, fairly well filled, but somewhat irregular in shape in a few cases; attachment to shank rather open; tips, blunt and generally exposed.

Kernels, large and shallow on cob; slightly longer than wide; color, pearly white, occasionally opaque; generally flinty; but with tendency to become dent; well paired; rows of kernels, fairly straight and close; typical number of rows, 14; germs, bright and large and extend well up to the crown; shelling percentage, 70.

Cobs, large and white.

The plants are large; typical height, 2.6 meters; leaves, broad and long.

Baluga Yellow Flint (See Plate No. V-b).—Ears, slightly tapering; long and slender; medium in size; butts, slightly rounded and fairly well filled; tips, blunt and generally exposed.

Kernels, large, set on cob rather deep; length and width, relatively equal; color, blood red yellow, with starchy caps; flinty; well paired; rows of kernels, fairly straight and close; typical number, 12; germs, bright and large extending well up to the crown; proportion of grains to ear 76 per cent by weight.

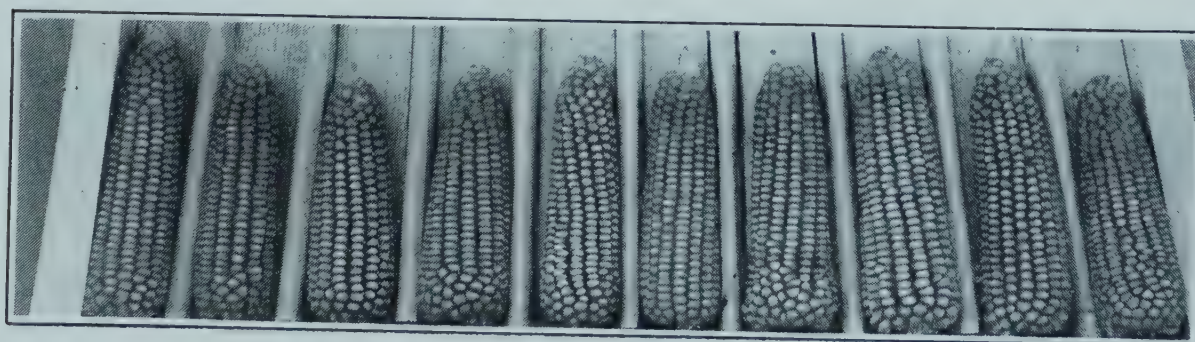
Cobs, medium in size and white in color.

The plants are of medium size; typical height, 2.5 meters; leaves are of medium length but narrow.

Cagayan Yellow Flint (See Plate No. VI-a).—Ears, tapering, rather long and slender, medium in size; butts, generally well filled but grains are unevenly set; tips, blunt and exposed.



(a) Bohol white



(b) Cebu white



(a) Moro white



(b) Baluga yellow

Kernels, large and shallow on cob; rounded; color lemon yellow, rounded, with starchy caps; grains, fairly well paired; rows of kernels, fairly straight and close; typical number 12; germs, bright, large and extend quite high to the crown; grains shell at 72 per cent.

Cobs, medium in size and white in color.

The plants are of medium size; typical height, 2.5 meters; the leaves, medium in length but quite broad.

Calamba Yellow Flint (See Plate No. VI-b).—Ears, medium in size; tapering; butts, fairly well filled and rounded; tips, blunt and exposed.

Kernels, small and shallow on cob; nearly rounded; color, light yellow with slightly starchy caps flinty; grains, well paired and closed; 16 rows of kernels; germs, bright and large; grains, 75 per cent of ears by weight.

Cobs, medium in size and white in color.

Plants of medium size; typical height, 2.5 meters; leaves, medium in length but relatively broad.

The different varieties were planted in separate half hectare, rectangular plots, 50 meters wide. These plots were located in different but not widely separated places at the station. They were so located, however, that when the wind blew, there was less probability for the pollen grains of being carried from one plot to another.

For convenience the different plots were designated as Plot A, Plot B, Plot C, Plot D, Plot E, and Plot F. The original idea was to plant each variety in each plot in succession. Between Plots E and F, which were near each other, a windbreak five meters high made of bamboo and native grass (tigbao) was constructed. The object was to prevent or at least reduce the chance of cross-pollination between the varieties planted in these two plots.

As a means of minimizing the error that might arise due to difference in soil fertility, two check-rows were planted in the middle of each plot parallel to the rows of corn. It will be noted elsewhere in this article that due correction was made in the results because of possibility of error resulting from this difference in soil fertility.

In this experiment efforts were made to keep every culture as pure as possible. This end was attained partly by constant and

thorough selection and elimination of foreign grains that appeared in the product and by planting each variety by itself.

The ground in all the plots was prepared as uniformly as possible.

The spacing of one meter between the rows and 50 centimeters between the hills was uniform throughout the field. Three to two seeds were planted to the hill but only one plant was allowed to develop in each hill.

The following table shows in detail the results of the tests and other data:

TABLE No. 2

Test No.	Variety name	Area planted	Date planted	No. of days from planting to maturity	Percentage		
					Stand	Shelling	Shrinkage
		<i>Hectare</i>		<i>Days</i>			
1	Bohol White Flint.....	0.5	9-19-19	108	70.82	70.00	33.61
2	Do.....	0.5	4-30-20	100	81.46	77.83	32.50
3	Do.....	0.5	11-22-20	107	79.93	77.11	31.25
	Total.....					224.94	97.36
	Average.....					74.98	32.45
1	Cebu White Flint.....	0.5	9-19-19	104	85.36	80.00	27.35
2	Do.....	0.5	4-30-20	100	78.26	86.65	30.61
3	Do.....	0.5	11-22-20	106	81.67	80.09	31.25
	Total.....					247.74	89.21
	Average.....					82.25	29.74
1	Moro White Flint.....	0.5	9-19-19	100	94.87	66.42	27.55
2	Do.....	0.5	4-30-20	98	72.40	70.99	21.94
3	Do.....	0.5	11-22-20	103	71.88	71.20	25.88
	Total.....					208.61	75.37
	Average.....					69.54	25.12
1	Baluga Yellow Flint.....	0.5	9-19-19	96	69.12	74.00	31.22
2	Do.....	0.5	4-30-20	96	76.34	76.20	27.65
3	Do.....	0.5	11-22-20	102	77.36	78.33	27.34
	Total.....					228.53	86.21
	Average.....					76.17	28.74
1	Cagayan Yellow Flint.....	0.5	9-19-19	96	80.74	65.00	25.86
2	Do.....	0.5	4-30-20	97	73.78	75.66	23.91
3	Do.....	0.5	11-22-20	109	67.21	74.75	27.65
	Total.....					215.41	77.42
	Average.....					71.80	25.81
1	Calamba Yellow Flint.....	0.5	9-19-19	96	84.95	69.69	25.50
2	Do.....	0.5	4-30-20	93	79.10	77.27	29.78
3	Do.....	0.5	11-22-20	105	75.68	76.38	22.20
	Total.....					223.34	77.48
	Average.....					74.45	25.83

Standard used for computed yield based on check crop:

	Kilos
Average of first series.....	38.33
Average of second series.....	44.67
Average of third series.....	29.40



(a) Cagayan yellow



(b) Calamba yellow

TABLE No. 3

Yield per hectare shelled corn			No. of days of rain	Amount of rainfall during period of growth	Remarks
Based on actual crop harvested	Corrected based on 100 per cent stand	Corrected based on check crop			
<i>Cavan</i>	<i>Cavan</i>	<i>Cavan</i>		<i>mm.</i>	
16.46	23.24	11.75	58	888.5	Typhoon occurred during early stage of growth. Soft-rot, stalk and ear borers attacked plants. Maturity of plants uniform.
27.64	33.93	.....	62	1,469.1
27.52	34.43	19.08	29	329.4	
71.62	91.60	30.83	Typhoon occurred during early period of growth. Soft-rot, stalk and ear borers attacked plants. Maturity uniform.
23.87	30.53	15.41	.....	.....
20.13	23.58	24.92	57	883.9	
27.56	35.22	31.93	62	1,469.1	
31.58	38.67	27.71	29	329.4	
79.27	97.47	84.66	Typhoon occurred during early stage of growth. Soft-rot, stalk and ear borers attacked plants. Maturity fairly uniform.
26.42	32.49	28.22	.....	.....
23.58	24.85	21.23	55	876.7	
32.58	45.00	33.97	61	1,468.1	
25.24	35.11	24.76	28	328.9	
81.40	104.96	79.96	Typhoon occurred during early stage of growth. Soft-rot, stalk and ear borers attacked plants. Maturity quite uniform.
27.13	34.98	26.65	.....	.....
16.16	23.38	18.41	51	866.0	
44.76	58.64	38.37	60	1,442.8	
33.22	42.94	26.75	28	326.9	
94.14	124.96	83.53	Do.
31.38	41.65	27.51	.....	.....
10.16	12.58	12.51	51	866.0	
36.66	49.69	30.43	61	1,468.1	
28.39	42.24	36.28	29	329.4	
75.21	104.51	79.22	Do.
25.07	34.84	26.40	.....	.....
20.61	24.26	20.76	51	866.0	
41.44	52.39	32.19	58	1,441.5	
21.30	28.24	.....	28	326.9
83.35	105.89	52.95	
27.78	35.29	26.47	

DISCUSSION OF RESULTS

It will be recalled that the cultures were conducted during distinctly different seasons of the year. An attempt was made to show the effect of the varying amount of rainfall during the growing period of a variety.

In the first series, on account of the damage caused by typhoons which injured the growing plants at the early stage of growth, only 0.25 hectare was used as the basis for computation of yield per hectare although 0.5 hectare was actually planted to each variety. In all other series, however, one-half (0.5 hectare) was used as the basis.

Baluga Yellow Flint, as may be seen in Table 2, outyielded every other variety in the test. Bohol White Flint was the lowest yielder giving an average of 23.87 cavans of shelled corn per hectare. The increase of the Baluga Yellow Flint over this variety is 7.51 cavans or 23.6 per cent and 3.6 cavans over the

Calamba Yellow Flint, the second highest yielder. This increase is equivalent to 11.1 per cent.

The Baluga Yellow Flint also outyielded every other variety in the yield based on stand. An increase of 6.36 cavans per hectare or 15.2 per cent was made over Calamba Yellow Flint, the second highest yielding variety in the test. The increase over Bohol White, the lowest yielder, amounted to 11.12 cavans or 26.9 per cent. The Baluga Yellow Flint outyielded also all varieties except Cebu White but the difference was almost negligible.

SUMMARY OF CONCLUSIONS

The Baluga Yellow Flint was the highest yielder of the varieties tested and the average yields per hectare, in three successive seasons were 31.38, 41.65, and 27.57 cavans shelled corn, based on 100 per cent stand and based on check crop, respectively.

Baluga Yellow Flint besides being a high yielder was also a uniform and early maturing variety of corn.

Baluga Yellow Flint and Cebu White Flint did the best during the dry season, the yields per hectare being 33.22 cavans and 31.58, respectively. Calamba Yellow Flint was a good wet season corn, although Baluga Yellow Flint outyielded it also as well as the others used in the test.

Baluga Yellow Flint has shown the best results for both the wet and dry season plantings.

Moro White Flint was the least susceptible to soft-rot disease and stalk and ear borers while Cebu White Flint the most susceptible. Soft-rot, stalk, and ear borers were more prevalent during the rainy season than during the dry season.

FOOD VALUE

Analyses made at the Bureau of Science of the different varieties used in this test showed that the variation in the proteins, fats, and carbohydrate contents was very little except in the case of Bohol White Flint and Cagayan Yellow Flint where the difference was quite appreciable as regards protein content, and in the case of the Cagayan Yellow Flint the fat content of this variety was quite big.

The different varieties had practically the same value in cooking quality, when the corn was boiled green. They were equally as sweet and flinty. Roasting Cebu White Flint, on account of the kernel being deeply set on cobs, is quite disadvantageous as while a greater portion of the kernels remain uncooked the other portion is already quite well burned. In rice-corn preparation, however, it was observed that the Cebu White Flint is the best,

the kernels presenting a hard rice-like appearance which when cooked may be mistaken for real rice.

As to color, there are some who like the white while others, the yellow although there is practically no difference in the result of the choice.

Varieties	Protein	Fat	Carbo- hydrates
	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>
Moro White Flint.	7.21	4.31	73.48
Cebu White Flint.	7.35	4.21	74.17
Bohol White Flint.	6.61	4.32	74.83
Baluga Yellow Flint.	7.65	4.46	74.28
Cagayan Yellow Flint.	6.78	6.15	73.12
Calamba Yellow Flint.	7.56	4.66	73.65

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EXPERIMENTS ON VEGETATIVE PROPAGATION OF TROPICAL FRUITS AT THE LAMAO EXPERI- MENT STATION, LAMAO, BATAAN

By F. G. GALANG AND ANIANO R. ELAYDA

Investigational work on the vegetative propagation of tropical fruit trees is one of the principal activities carried on under Miscellaneous Tropical Fruits project at the Lamao Experiment Station. The results of the work along this line previous to 1921 have been reported and published from time to time in THE PHILIPPINE AGRICULTURAL REVIEW, "THE PHILIPPINE FARMER," and Bulletin No. 32, Plant Propagation in the Tropics, by P. J. Wester.

Most of the directions given below are drawn from the results of recent trials conducted by one of the authors, Aniano R. Elayda, Assistant in Horticulture of the Bureau of Agriculture, formerly assigned to Lamao Experiment Station.

SHIELD BUDDING

ORANGE, *Citrus sinensis*, *Pummelo*, *C. maxima*, and *Calamondin*, *C. mitis rebudded on Vilatti*, *Feronia limonia* and *vice-versa*.—Use either petioled or non-petioled rather matured but green-colored budwood; cut the bud from 2 to 3 centimeters long and insert it in the stock where the bark is from greenish to light brown in color.

IBA, *Cicca acida* budded on *Nelli*, *Phyllanthus emblica*.—Use either petioled or non-petioled, light green colored budwood; cut the bud 3.5 to 4 centimeters long and insert it in the stock where the bark is grayish green.

SEAGRAPE (*Coccoloba* sp.) budded on *Nelli* (*Phyllanthus emblica*).—Use non-petioled budwood of second growth; cut the bud from 4 to 5 centimeters long; age of stock at the point of insertion is unimportant.

At the Singalong Propagating and Testing Station Rima (*Artocarpus communis*) was also successfully budded on Camansi (*Artocarpus* sp.).

CLEFT GRAFTING

KARANDA, *Carissa carandas* grafted on *Perunkila*, *Carissa* sp.—Use well matured scion, 8 to 10 centimeters long and 7 to 10 millimeters in diameter, with 2 or 3 nodes; insert it in a stock of nearly the same size and color as the scion.

PILI, *Canarium ovatum* grafted on *Pisa*, *Canarium luzonicum*.—Use non-petioled scion, 8 to 10 centimeters long and 8 to 10 millimeters in diameter; insert it in a stock at the point of nearly the same age and size as the scion.

KAYAN, *Inocarpus edulis* grafted on *Kayan*.—Use non-petioled, well matured scion, 8 to 10 centimeters long and 8 to 10 millimeters in diameter; insert it in a stock at the point of nearly the same age and size as the scion.

LITCHI, *Litchi chinensis* grafted on *Laguan*, *Nephelium* sp.—Use non-petioled brownish gray and matured scion; cut the scion 8 to 12 centimeters long and insert it at the stock of nearly the same size, age, and color.

LIME, *Citrus aurantifolia* grafted on *Limoncito*, *Triphasia trifolia*.—Use petioled, rather mature but green colored scion; cut the scion 7 to 10 centimeters long and insert it in the stock of nearly the same size as the scion.

BANAUAK, *Uvaria rufa* grafted on *Maron*, *Annona montana*.—Use non-petioled scion, 8 to 10 centimeters long and about one centimeter in diameter; age and size of stock unimportant.

DALINSI, *Terminalia edulis* grafted on *Dalinsi*.—Use petioled or non-petioled scion but rather matured and brownish in color; cut the scion so that it will contain 3 to 4 nodes. Insert it in the stock of nearly the same age and size.

DALINSI, *Terminalia edulis* grafted on *Talisay*, *T. catapa*. Directions same as that for Dalinsi.

INARCHING

The following plants have been successfully inarched:

PILI, *Canarium ovatum* on *Pisa*, *C. luzonicum*.

RIMA, *Artocarpus communis* on *Jak*, *A. integra*.

RIMA, *Artocarpus communis* on *Gomihan*, *A. elastica*, and vice-versa.

LEMASA, *A. champeden* on *Jak*, *A. integra*.

RIMA, *A. communis* on *Camansi*, *A. sp.*

MARCOTTAGE

Various species of *Citrus*, *Yambo*, *Eugenia* sp. *Makopa*, *Eugenia javanica* and the *Rima*, *Artocarpus communis* were success-

fully marcotted. Use vigorous and symmetrical branches with a diameter of from 2 to 6 centimeters. Perform the operation during the rainy season. The marcots should be watered from time to time during the dry season.

CUTTINGS

Cuttings of the following plants have been successfully grown. Pangao, *Sterculia oblongata*, Iba, *Cicca acida*, Hondapara, *Dillenia indica*, Tersana, *Eugenia malaccensis*, Ketembilla, *Dovyalis hebecarpa*, Palali, *Dillenia reifferscheidia* and Vilatti, *Feronia limonia*.

VARIETY TEST OF CABBAGE

By E. K. MORADA, *Assistant in Horticulture*

This experiment was conducted with the object of finding out the relative merits of the different varieties of cabbage when grown side by side. The results presented here are to be considered only in soils similar to that of Lamao Experiment Station, Lamao, Bataan and climatic conditions prevailing there where the experiment has been carried out. The experiment was performed from October, 1921, to April of the following year.

MATERIALS AND METHODS

VARIETIES USED

Seeds of the following varieties were obtained in 1921 from T. W. Wood and Sons, Richmond, Virginia, United States of America.

1. Early Jersey Wakefield.
2. Early Flat Dutch.
3. Solid South.
4. Wood's Extra Early.
5. Late Flat Dutch.
6. Sure Head.
7. Early Winningstadt.
8. Henderson's Early Summer.

There was no data as to the age of the seeds or whether the seeds used in this experiment were harvested from plants planted at different times. The vitality of the seeds influence more or less the yield of the variety in question. However, the seeds were grown under the same conditions and at the same time, so that the effect in yield, if any, would be very slight.

DESCRIPTION OF VARIETIES

1. *Early Jersey Wakefield*.—An early variety with solid, very compact, heavy, conical heads, averaging 0.63 kilo in weight. It is a fair producer of heads.

2. *Early Flat Dutch*.—Another early variety with solid almost round, flat heads, averaging 0.34 kilo in weight.

3. *Solid South*.—A late variety with big solid, as the name indicates, nearly round heads, averaging 0.58 kilo in weight.

It is a good producer and well adapted to Lamac conditions. It ranks second in yield.

4. *Wood's Extra Early*.—An early variety, producing, nearly round, solid heads, weighing 0.38 kilo.

5. *Late Flat Dutch*.—A late variety, with big solid, almost round flat heads, with an average weight of 0.72 kilo. It is the best producer among the varieties and is an excellent variety for planting under Lamac conditions.

6. *Sure Head*.—A late variety, with big, solid nearly round heads, averaging 0.61 kilo in weight. It is not a very sure producer, and ranks third in yield.

7. *Early Winningstadt*.—Another early variety producing sharp conical and small, very solid heads weighing 0.41 kilo. The leaves are shorter than those of the other varieties. It is the best producer of heads.

8. *Henderson's Early Summer*.—Another early variety producing fairly big, nearly round, solid heads, averaging 0.52 kilo in weight.

CLASSIFICATION

In order to distinguish the different varieties and to give the advantages and disadvantages of each type, an attempt was made to classify them for the information of those who desire to plant them, as follows:

1. *Late and early varieties*.—The lateness or earliness of a variety is influenced by the soil and climatic conditions. The varieties that are late or early in the United States may not be so in our locality. The plantings made were not enough to give sufficient and reliable data to warrant their classification into late and early varieties. Consequently, this classification is not used.

2. *Varieties producing round heads and varieties producing conical heads*.—(a) Varieties belonging to the round type of heads are:

1. Early Flat Dutch.
2. Solid South.
3. Wood's Extra Early.
4. Late Flat Dutch.
5. Sure Head.
6. Henderson's Early Summer.

(b) Varieties belonging to the conical type of heads are:

1. Early Jersey Wakefield.
2. Early Winningstadt.

The best yielders and producers of the biggest and heaviest heads were found among the round type of heads. However, this type is not a sure producer of heads as the other type. The varieties of the conical type are not good yielders as stated above but they are the best producers of heads.

PLAN OF WORK

Table I shows the rainfall during 1921-22.

The ground used in this experiment is a slight slope which can be irrigated easily. The ground which is clay loam, was previously planted to other crops. It was divided into eleven beds each measuring 1.3 meters wide, 9 meters long and 10 centimeters high. Between the beds were paths, 50 centimeters wide. They were made parallel to the slope of the ground. The beds were dug up with spading fork and raked thoroughly twice, to make them level and to pulverize the soil. Before digging the soil, four wheelbarrows of composted soil weighing about 161.4 kilos were spread on each bed, and mixed thoroughly.

Each variety was planted in each bed. Three check beds were provided for; one at each end and one at the center of the field to determine any variation in the fertility of the soil. The early Jersey Wakefield was used as the check variety. Table 2 gives the arrangement of the beds and the variety planted in each bed.

The seeds were sown in seed flats on October 14, 1921, and picked to other flats on October 20 and 21, 1921. On November 12, 1921, the seedlings were transplanted, when the third pair of leaves appeared, in the beds at a distance of 50 by 50 centimeters. They were shaded from the heat of the sun with banana sheaths of about 30 centimeters long for 5 consecutive days. During the first two weeks they were watered every day with the aid of a sprinkling can, but afterwards they were irrigated twice a week by the flooding system. The water was allowed to run along the paths, and it was thrown carefully into the beds.

Cultivation was performed twice a week with the planet junior cultivator and supplemented with a garden hoe.

The percentage of heading, the date, number, and weight of heads, harvested from each bed were recorded.

YIELD

The yield per hectare was taken as the basis of computation. The heads destroyed by worms were included in the computation of yield. Table 2, gives the method of computing the yield.

From the yields of the check variety on beds, 1, 6, and 11 which were 26,863.24; 25,649.57; and 26,769.23 kilos respectively, it could be seen that the soil is richer from the center toward the two ends of the field employed and that the end where the check No. 1 was, was slightly richer than the other end. Consequently, the theoretical yields would increase from the center toward the two ends or it would decrease from the ends to the center. The results, obtained by dividing the difference in the yields of the two succeeding checks with the number of beds, lying between the two checks, plus one bed of the checks just treated, would be the amount by which each theoretical yield of the imaginary checks increases from the center to check No. 1, beginning from the lower yield of the check. The theoretical yields of the imaginary checks, occupied by the non-check varieties were subtracted algebraically from the corresponding actual yields of the varieties, planted between the two checks to get the computed theoretical yield of each bed, planted to each variety.

DISCUSSION OF RESULTS

Table 4, gives the summary of results.

From this table it can be seen that the percentage of germination of the different varieties varies from 60 per cent to 85 per cent.

Not all the cabbage plants of all the varieties produced heads. They varied from 78 per cent to 92 per cent, depending upon the variety. Early Winningstadt has the highest percentage of productivity, which is 92 per cent; Wood's Extra Early, second with 90.19 per cent; Early Jersey Wakefield, third with 88.13 per cent (taking into consideration all the beds planted to this latter variety); Early Flat Dutch, fourth with 86.27 per cent; Solid South and Henderson's Early Summer, fifth with 84.31 per cent each; Late Flat Dutch, sixth with 82.35 per cent; and Sure Head, last with 78 per cent. In general, the varieties, producing conical heads are better producers of heads than those producing round ones.

The Solid South, Wood's Extra Early, Late Flat Dutch, Sure Head, Early Jersey Wakefield, and Henderson's Early Summer varieties produced matured heads in 130 days from the time of planting and the Early Dutch and Early Winningstadt in 139 days.

As to the computed yield per hectare the Late Flat Dutch was the heaviest yielder which produced 26,338.45 kilos to the hectare; Solid South, second with 21,399.99 kilos; Sure Head, third with 20,694.86 kilos; Henderson's Early Summer, fourth with 11,869.22 kilos; Early Winningstadt fifth with 16,212.81 kilos; Wood's Extra Early, sixth with 15,112.81 kilos; Early Jersey Wakefield, seventh with 13,864.09 kilos; and Early Flat Dutch was last with 12,439.30 kilos.

With regard to the average weight of heads the Late Flat Dutch, produced, the heaviest weighing 0.72 kilo; Sure Head, second, 0.61 kilo; Solid South, third, 0.58 kilo; Henderson's Early Summer, fourth, 0.52 kilo; Early Jersey Wakefield, fifth, 0.42 kilo; Early Winningstadt, sixth, 0.41 kilo; Wood's Extra Early, seventh, 0.38 kilo; and Early Flat Dutch, eighth, 0.34 kilo.

The varieties, producing the highest number of heads were not necessarily, the heaviest yielders. Heavy yielding depends upon the variety and the characteristics of the heads produced. The varieties with conical heads did not produce big heads and consequently they were not as good yielders as those with round and flat heads.

SUMMARY OF CONCLUSIONS

1. The varieties with conical heads are better producers of heads than those with round heads.

2. Late Flat Dutch, Solid South, Sure Head, Henderson's Early Summer, and Early Winningstadt are the best yielders in the order of their enumeration.

3. Late Flat Dutch, Sure Head, Solid South, Henderson's Early Summer, and Early Jersey Wakefield produce the biggest heads, in the order of their enumeration.

TABLE 1.—*Rainfall for 1921-1922*

Month	Rainfall	
	1921	1922
	<i>Inches</i>	<i>Inches</i>
January.....	0.5	.....
February.....	.4	.....
March.....	.....	2.00
April.....	7.71	10.42
May.....	6.36	9.30
June.....	10.00	35.12
July.....	55.50	8.62
August.....	8.20	18.91
September.....	2.62	7.98
October.....	16.74	1.66
November.....	.23	5.37
December.....	.....	.....
Total.....	108.26	99.38

TABLE 2.—Arrangement of beds and the variety planted in each bed

Bed No.	Variety name	Check No.
1	Early Jersey Wakefield.	Check I.
2	Early Flat Dutch.	
3	Solid South.	
4	Wood's Extra Early... ..	
5	Late Flat Dutch.	Check II.
6	Early Jersey Wakefield.	
7	Sure Head.	
8	Early Jersey Wakefield.	
9	Early Winningstadt.	Check III.
10	Henderson's Early Summer.	
11	Early Jersey Wakefield.	

TABLE 3.—Method of yield computation

Bed No.	Variety name	Actual yield per bed	Actual yield per hectare	Theoretical yield per hectare of non-check beds	Difference between actual yield and theoretical yield in these rows	Average theoretical yield of check rows	Theoretical yield per hectare of non-check beds
		Kilos	Kilos	Kilos	Kilos	Kilos.	Kilos
1	Check No. 1.....	31.43	26,863.24	26,620.50	—13,817.096	26,256.40	12,439.30
2	Early Flat Dutch.....	14.98	12,803.41	26,377.77	—4,856.412	26,256.40	21,399.99
3	Solid South.....	25.18	21,521.36	26,135.03	—11,143.588	26,256.40	15,112.81
4	Wood's Extra Early.....	17.54	14,991.45	25,892.30	82.046	26,256.40	26,338.45
5	Late Flat Dutch.....	30.39	25,974.35				
6	Check No. 2.....	30.01	25,649.57				
7	Sure Head.....	23.82	20,358.97	25,873.50	—5,514.532	26,209.40	20,694.86
8	Early Jersey Wakefield.....	16.09	13,752.13	26,097.45	—12,345.304	26,209.40	13,864.09
9	Early Winningstadt.....	19.10	16,324.78	26,321.36	—9,996.586	26,209.40	16,212.81
10	Hendarson's Early Summer.....	22.47	19,205.12	26,545.29	—7,340.178	26,209.40	18,869.22
11	Check No 3.....	31.32	26,769.23				

REMARKS: In the actual yield per bed, the heads, destroyed by worms were included.
Source—T. W. Wood's & Sons, Richmond, Virginia, United States of America.
Date of planting—October 14, 1921.
Amount planted in each bed—2 grams.
Method—Broadcasting in seedflats.
Date of Germination—October 17, 1921.
Date of pricked—October 20-21, 1921.
Date of transplanting—November 14, 1921.
Spacing in centimeter—50 by 50 centimeters.
Method—Transplanted in rows in bed.
Area planted in square meter—117 square meters (individual bed).
Cultivation required—Twice a week.
Method—By the use of planet junior cultivator supplemented by hoeing.
Irrigation—Twice a week.
Method—By flooding.
Fertilizer used—Four wheelbarrows (161.4 kilos) Compost applied in each bed.

TABLE 4.—Summary of results of experiment

Bed No.	Variety name	Germi- nation	Number of plants	Number of plants with heads	Heading	Date harvested	Number of heads har- vested	Actual yield	Average weight of head	Computed yield per hectare	Rank in yield per hectare	Rank in average weight of head
		Per cent			Per cent			Kilos	Kilos	Kilos		
1	(C) Early Jersey Wakefield.	.....	50	46	92.00	2-14-3-10-22	32	21.91	0.68	.....	.....	.....
2	Early Flat Dutch.	80	51	44	86.27	3-2-10-22	21	7.16	.34	12,439.30	8	8
3	Solid South.	80	51	43	84.31	2-21-3-10-22	28	16.48	.58	21,399.99	2	3
4	Wood's Extra Early.	75	51	46	90.19	2-21-3-10-22	25	9.56	.38	15,112.81	6	7
5	Late Flat Dutch.	80	51	42	82.35	2-21-3-10-22	23	16.71	.72	26,338.45	1	1
6	(C) Early Jersey Wakefield.	.....	44	42	95.45	2-21-3-10-22	23	16.52	.71	.....	.....	.....
7	Sure Head.	80	50	39	78.00	2-21-3-7-22	19	11.62	.61	20,694.86	3	2
8	Early Jersey Wakefield.	85	48	38	79.17	2-21-3-10-22	23	9.79	.42	13,864.09	7	5
9	Early Winningstadt.	60	50	46	92.00	3-2-10-22	29	12.13	.41	16,212.81	5	6
10	Henderson's Early Summer.	70	51	43	84.31	2-21-3-10-22	28	14.67	.52	18,869.22	4	4
11	(C) Early Jersey Wakefield.	.....	49	42	85.91	2-21-3-10-22	26	19.48	.74	.....	.....	.....

REMARKS:
Beds 1, 6, and 11 are the check beds.
The heads, destroyed by worms were included in the calculation of yield.
The plants were allowed to develop to let them flower after removing the heads. No flowers were produced.

THE GOVERNMENT OF THE PHILIPPINE ISLANDS
DEPARTMENT OF AGRICULTURE AND NATURAL RESOURCES
BUREAU OF AGRICULTURE

MANILA, *July 29, 1924.*

**Subject: Regulations Governing Certain Phases of the Grading,
Baling, and Inspection of Philippine Fibers**

ADMINISTRATIVE ORDER NO. 44

In accordance with the provisions of Article III of Chapter 46 of Title VII of Book II of the Revised Administrative Code, the following regulations governing certain phases of the grading, baling, and inspection of Philippine fibers are hereby issued for the information and guidance of all concerned:

These regulations cover the following subjects, namely:
(1) Designation of the official standard grades for each fiber included in Article III of Chapter 46 of Title VII of Book II of the Revised Administrative Code; (2) determination of the standard grades and types thereof; (3) additional regulations regarding baling, labeling, and inspection; and (4) cancellation of previous Administrative Order.

ARTICLE I.—*Designation of official standard grades*

The following named Philippine fibers are included under these regulations and a separate set of standard grades is established for each:

- (1) Abaca: Of excellent cleaning, specially prepared for tagal braid or other fine textile purposes.
- (2) Abaca: Of excellent or good cleaning.
- (3) Abaca: Strips or partially cleaned fiber.
- (4) Abaca: Woody and waste fibers.
- (5) Maguey or Sisal: Retted.

(6) Cantala (maguey) or Sisal: Knife- or machine-cleaned.

(7) Pacol and Canton.

SECTION 1. *Abaca: Of excellent cleaning, specially prepared for tagal braid or other fine textile purposes.*—The following grades shall be the official standards of classification for this fiber only when the product is carefully sorted; cleaned of all tow; of more uniform color, cleaning and texture than is required in subsequent standards:

Letter designation	Name of grade
AA	Tagal-one.
BB	Tagal-two.
CC	Tagal-three.
DD	Tagal-four.
EE	Tagal-five.

SEC. 2. *Abaca: Of excellent or good cleaning.*—The following grades shall be the official standards of classification for this fiber only when the product is in the form of fiber, i. e., well cleaned:

Letter designation	Name of grade
A	Extra Prime.
B	Prime.
C	Superior Current.
D	Good Current.
E	Midway.
S1	Streaky No. 1.
S2	Streaky No. 2.
S3	Streaky No. 3.
F	Current.
G	Seconds.
H	Brown.

SEC. 3. *Abaca: Strips or partially cleaned fiber.*—There shall be six grades of abaca when the fiber is prepared in the form of strips, which shall be designated as follows:

Letter designation	Name of grade
I	Good Fair.
J1	Fair No. 1.
J2	Fair No. 2.
K	Medium.
L	Coarse.
M	Coarse Brown.

SEC. 4. *Abaca: Woody and waste fibers.*—There shall be twelve grades of abaca when the fiber is hard and woody, damaged, or in the form of strings tow or waste, which shall be designated as follows:

Letter designation	Name of grade
DL	Daet Coarse.
DM	Daet Coarse Brown.
O1	Strings No. 1 (Grades A to I, inclusive).
O2	Strings No. 2 (Grades J1 to K, inclusive)
O3	Strings No. 3 (Grades L to DM, inclusive)
T1	Tow No. 1 (Grades A to I, inclusive).
T2	Tow No. 2 (Grades J1 to K, inclusive).
T3	Tow No. 3 (Grades L to DM, inclusive).
Y1	Damaged No. 1 (Grades A to I, inclusive).
Y2	Damaged No. 2 (Grades J1 to K, inclusive).
Y3	Damaged No. 3 (Grades L to DM, inclusive).
W	Waste.

SEC. 5. *Maguey or Sisal: Retted.*—There shall be seven grades of maguey or sisal when the fiber is separated by retting the leaves in water. These grades shall be designated as follows:

Letter designation	Name of grade
MR or SR 1	Maguey or Sisal No. 1.
MR or SR 2	Maguey or Sisal No. 2.
MR or SR 3	Maguey or Sisal No. 3.
MR or SR O	Maguey or Sisal Strings.
MR or SR T	Maguey or Sisal Tow.
MR or SR Y	Maguey or Sisal Damaged.
MR or SR W	Maguey or Sisal Waste.

SEC. 6. *Cantala (maguey) or Sisal: Knife- or machine-cleaned.*—The grades for either cantala or sisal when cleaned by machinery or by knife shall be nine in number, designated as follows:

Letter designation	Name of grade
CL or SL A	Cantala or Sisal, Good.
CL or SL B	Cantala or Sisal, Fair.
CL or SL C	Cantala or Sisal, Common.
CL or SL R	Cantala or Sisal, Red.
CL or SL S	Cantala or Sisal, Very Short.
CL or SL O	Cantala or Sisal, Strings.
CL or SL T	Cantala or Sisal, Tow.
CL or SL Y	Cantala or Sisal, Damaged.
CL or SL W	Cantala or Sisal, Waste.

SEC. 7. *Pacol and Canton.*—These fibers are produced in certain parts of the Philippine Islands from plants known by the same names, which resemble both abaca and banana. Although Canton is stronger than Pacol, both are considerably weaker than abaca and the adulteration of one with the other and the mixing of either or both with abaca is strictly prohibited.

Pacol shall be graded as Pacol No. 1 (Pcl 1), the well-cleaned fiber (white or dark), and Pacol No. 2 (Pcl 2), the strips or partially cleaned fiber.

There shall be as many grades of Canton as there are for abaca, but the letter-designation must in all cases be preceded by the letters "*Can*," as "*Can F*," etc., in the case of Canton fiber.

The basis of classification of Canton fiber shall be the same as that adopted for abaca of the same grades, and shall be based mainly on color and cleaning.

The above-mentioned fibers shall be graded under separate lot numbers from those of abaca and other fibers, and separate certificates shall be issued for them by the fiber inspector.

Abaca fiber that has been adulterated with either Canton or Pacol fiber in such a way as to make it impracticable to separate the two, shall be graded as Canton or Pacol without regard to the percentage of pure abaca fiber that may be mixed with either of these two inferior fibers.

All bales of Canton or Pacol fiber shall have printed across the bales in types at least 3 inches high the word "*Canton*" or "*Pacol*" in addition to the Government grading letter-designation and the Government stamp on the muslin tag in the bale.

ARTICLE II.—*Designation of grades and types*

The grading of fiber in standards included in Article I of this order shall be based on its tensile strength, color, and cleaning, except Pacol and Canton fibers which shall be based mainly on color and cleaning, as follows:

Tensile strength.—This is a basic quality, and under this system the fibers must possess an average normal breaking strength in order that it may be graded to any of the standards established in this order; otherwise, it will be graded as "damaged." (See section 4, Article I.) If the proportion of weak or damaged fiber in a lot is not sufficiently high to justify the above action, then the only recourse shall be the rejection of the whole lot for sorting the weak fiber from that of normal strength. Ordinarily, practical observation and hand tests are sufficient to indicate whether or not a certain fiber possesses normal strength. In cases of doubt or dispute, however, the fiber inspector shall verify his finding by making tests with adequate strength-testing machines provided by the Government for this purpose.

Color.—The tensile strength of a lot of fiber being good, the practical grading operation will be based on its color.

This quality, therefore, is the determining factor of grading well-cleaned abaca and knife- or machine-cleaned cantala (maguey) and sisal. The color of the abaca fiber ranges from brown or purple to white, and the extent of variation allowable between one grade and another is illustrated by standard samples prepared by the fiber division of the Bureau of Agriculture. These samples may be obtained by graders and buyers upon payment in advance of ₱1 per sample.

Cleaning.—The method or extent of cleaning (fiber extraction), often produces radical changes in the character and usefulness of the fiber, hence the establishment of a separate set of standard grades for abaca strips and one for retted maguey and sisal. In the grades included under these two sets of standards, the extent of cleaning is the determining factor, although color is also taken into consideration.

In describing the cleaning of the fiber in the certificates of inspection the following terms will be used:

“Excellent,” when the cleaning is perfect or nearly so, the product being pure fiber, as in the tagal grades (*see* section 1, Art. I) and also the grades “Extra Prime” to “Streaky No. 3” (*see* section 2, Art. I); in the grades “Cantala or Sisal A to C” (knife- or machine-cleaned) (*see* section 6, Art. I); and in the grades “Maguey or Sisal No. 1” (*see* section 5, Art. I).

“Good,” in the case of abaca, when the product is somewhat strippy, but the strips are fine, soft, and more or less intermixed with pure fiber, as in the grades “Current,” “Seconds,” “Brown,” and sometimes “Good Fair;” and in the case of retted maguey and sisal, when the fiber is to a small extent spotted with hard, gummy scales, as in the grade “Maguey or Sisal No. 2.”

“Fair,” in the case of abaca, when the product is distinctly strippy but the strips are narrow and thin, as in the grades “Good Fair,” “Fair No. 1,” “Fair No. 2,” and “Medium;” and in the case of retted maguey and sisal, when the gummy scales on the fiber are more or less prominent, as in the grades “Maguey or Sisal No. 3.”

“Coarse,” when the product is entirely strippy, and the strips are wide, pulpy, or both, as in the grades “Coarse,” “Coarse Brown,” and the two Daet grades.

In addition to strength, color, and extent of cleaning, there are two other characteristics in a fiber which do not

affect its grade but are often considered necessary to identify its type in any of the grades. These are *texture* and *length*.

The *texture* of a fiber, in most cases, varies according to its cleaning. This will, therefore, be designated as "Soft," "Medium," or "Hard," accordingly, as the cleaning is "excellent," "good," "fair," or "coarse." Some varieties of abaca in North and South Mindanao produce a fiber which is naturally of medium or hard texture, though it may be of excellent cleaning.

Under *length*, abaca fiber shall be designated "very long," when it exceeds 3 meters (10 feet); "long," when it is $2\frac{1}{2}$ to 3 meters (8 to 10 feet); "normal," when it is $1\frac{1}{2}$ to $2\frac{1}{2}$ meters (5 to 8 feet); and "short," when it is under $1\frac{1}{2}$ meters (5 feet).

Maguey and sisal will be designed "long," when 1 meter (40 inches) or more in length; "normal," when between 60 centimeters and 1 meter (24 to 40 inches); "short," when between 50 and 60 centimeters (20 to 24 inches); and "very short," when under 50 centimeters (20 inches).

ARTICLE III.—*Baling, labeling, and inspection*

The following additional regulations regarding baling, labeling, and inspection of bales shall be complied with by all grading establishments:

SECTION 1. Each hank in a bale of fiber for cordage purposes shall not exceed 12, nor be less than 6 centimeters in diameter before pressing, but in a bale for tagal braid each hank may be less than 6 centimeters.

Every bale of fiber shall be free from strings, waste, tow, damaged fiber, fiber not identical with that which constitutes the bale, or any extraneous matter, and the fiber shall be thoroughly dry.

All hanks of fiber in a bale shall be uniform in quality and each hank shall also be securely tied by a strand to hold the fibers together and which shall be identical with the fiber which constitutes the bale. The manner of tying the hank without forming a knot and the size of the strand to be used are illustrated in the standard samples. Neither end of the strand should be knotted.

SEC. 2. The dimensions of each bale of the grades "Tagal-one" to "Tagal-five" inclusive, may be increased not more than 40 per cent over the measurements prescribed in section 1783 of the Administrative Code (Act No. 2711).

SEC. 3. The division of each hank into two or three parts, and the twisting of these parts in a manner similar to the twisting of the strands of a rope, is prohibited. The hank may, however, be twisted once or twice as a whole sufficiently to keep the fibers together.

SEC. 4. The hanks shall be laid straight in the bale, the heads (butt ends) in one row alternating with the tips (points) of the next row. The hanks shall not be doubled upon themselves more than is absolutely necessary.

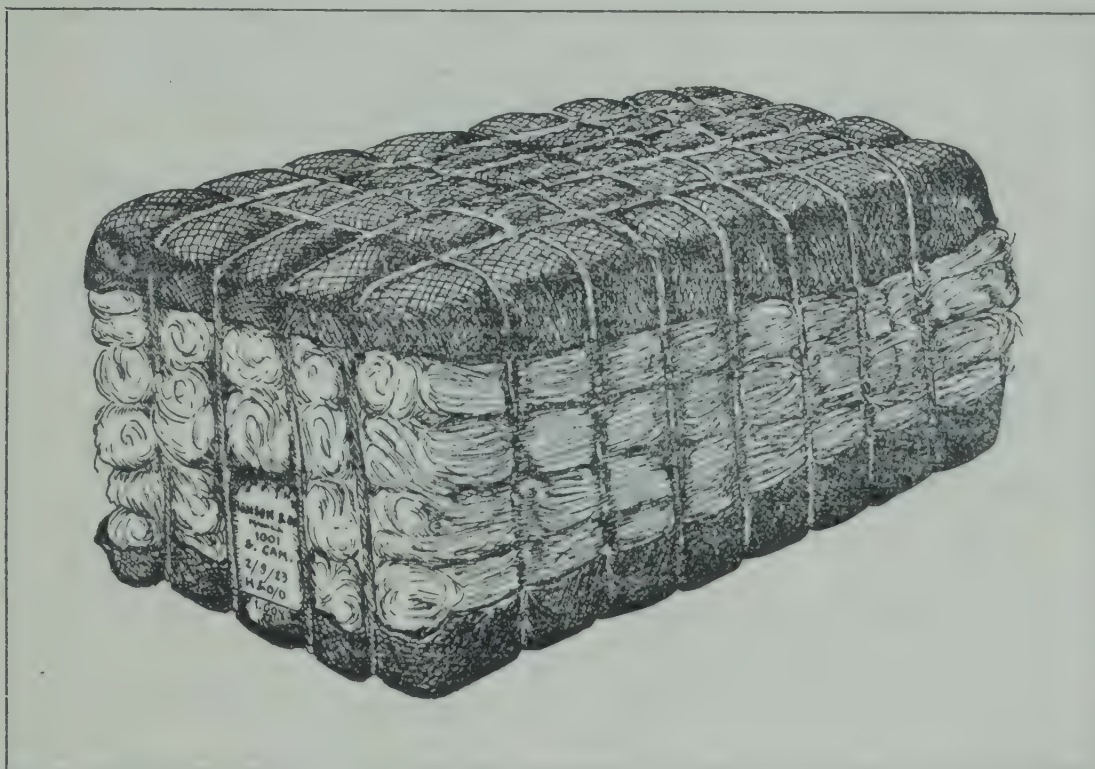


FIG. 1. The completed bale showing method of wrapping, binding, and tagging

SEC. 5. Each bale of fiber shall be securely bound with not more than eight side and four end bands, made of the same kind of fiber as that contained in the bale, or of bejuco (rattan). The outer bands shall not be nearer than 10 centimeters to the edge. (See figure 1.)

SEC. 6. All fiber on being graded shall be divided into lots. The fiber in each lot shall be of uniform type, but may be of more than one grade. The lots must be numbered consecutively, and a range of numbers will be furnished each grading establishment along with the grading permits, which numbers may be repeated as soon as exhausted. The inspection of a shipment of fiber shall be made on each lot separately, and a separate certificate of inspection given for each lot inspected. A lot of fiber shall be considered under inspection until all the bales of

all the grades included in it shall have been stamped and the required certificate of inspection issued therefor.

In order to avoid unnecessary confusion and to obtain uniformity in type, the attention of the graders is called to the necessity of dividing their lots in such a way as to have in one lot fiber which comes from one district or province only. Otherwise, any readjustment of lots may entail unnecessary trouble and expense to the grader.

In order to facilitate the division of fiber into lots uniform in type, the abaca producing provinces of the Philippine Islands shall be divided into the following districts, the product of each of which may be considered by the grader as uniform and may be included in one lot:

Province or island	District	Abbreviation
Albay	Albay	Albay.
Catanduanes	Catanduanes	Catanduanes.
Leyte	East Leyte	E. Ley.
	West Leyte	W. Ley.
Mindanao Island	North Mindanao	N. Min.
	South Mindanao	S. Min.
North Camarines	North Camarines	N. Cam.
Samar	North Samar	N. Sam.
	South Samar	S. Sam.
Sorsogon	North Sorsogon	N. Sor.
	South Sorsogon	S. Sor.
South Camarines	South Camarines	S. Cam.

The remaining abaca-producing provinces shall each be considered a separate district by itself.

In order to facilitate the identification of the baling establishment where a bale or bales of fiber in a lot were pressed, the following grading stations will be known by the following permanent initials which shall be placed before the pressmark separated by a bar:

Albay	Guinobatan ..	GN	Leyte	Maasin	MA
	Legaspi	L		Malitbog	MG
	Ligao	LI		Palompon	P
	Tabaco	T		Tacloban	TL
Catanduanes....	Virac	VC	Manila	Manila	M
Cebu	Cebu	C	Masbate	Masbate	MS
Davao	Davao	DA	Misamis	Cagayan	K
	Daliaon	DL	N. Camarines..	Daet	D
	Malita	ML	S. Camarines..	Iriga	IR
	Mati	MI		Lagonoy Dis. ..	LA
	Santa Cruz..	SC		Naga	N
	Talomo	TO		Nato	NT
Iloilo	Iloilo	I	Samar	Borongan	BO
Ilocos Sur	Vigan	V		Calbayog	CA
Leyte	Baybay	B		Catarman	CM
	Carigara	CR		Catbalogan ..	CT

Samar	Laoang	LM	Sorsogon	Matnog	MT
Sorsogon	Bulan	BU		Sorsogon	S
	Casiguran ..	CS	Surigao	Surigao	SU
	Donsol	DS	Tayabas	Mauban	MU
	Gubat	G	Zamboanga	Zamboanga ..	Z

SEC. 7. Each bale of fiber shall bear a tag of white, unstarched, cotton cloth not less than 75 centimeters long nor less than 10 centimeters wide. One end of this tag shall be placed at or near the middle of the bale, while the other end shall project about 12 centimeters beyond the end of the bale, and shall be clearly visible. (See fig. 1.) The end of the tag inside the bale shall be tied to one of the hanks in the middle of the bale and just below the tie shall bear the full or abbreviated name of the grading establishment, the name of the station, the number of the lot, the full or abbreviated name of the province or district of production, and the date of pressing. (See fig. 2, *a*, *b*, *c*, *d*, *e*.) The letter-designation of the grade should not appear on the end of the tag inside the bale. The end projecting beyond the bale shall be divided into two sections, the section adjacent to the bale shall bear the same data as are stamped on the end inside the bale, including the date of pressing, while the outer section shall bear the abbreviated name of the grading station accompanied by the pressmark and the official letter-designation of the grade, the three separated by bars, but forming one mark and, below this, the Government stamp giving the official name of the fiber and the official letter-designation of the grade. (See fig. 2, *a'*, *b'*, *c'*, *d'*, *e'*, *f*, *g*.)

The letters and numerals stamped on the cloth tag mentioned in this section shall not be less than 1 centimeter in height.

On the mats covering the two surfaces of the bale shall be stamped or stenciled in clear indelible ink the abbrev-

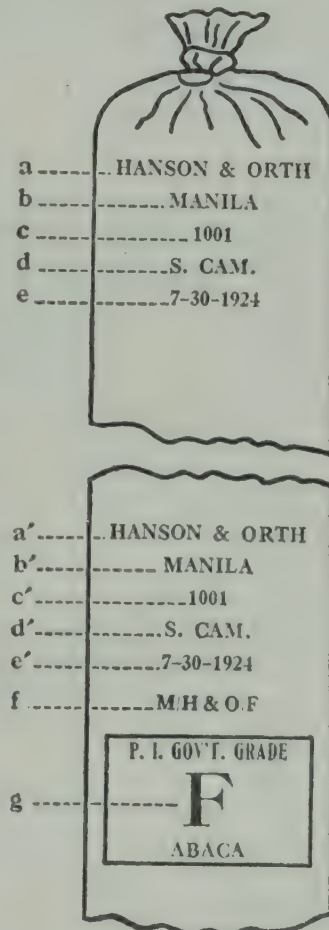


FIG. 2. Cloth tag showing (*a*, *a'*) name of grading establishment; (*b*, *b'*) name of station; (*c*, *c'*) lot number; (*d*, *d'*) district of production; (*e*, *e'*) date of pressing; (*f*) abbreviated name of grading station, press mark and letter designation of the grade, all forming one mark; and (*g*) Government stamp.

viated name of the grading station accompanied by the pressmark and the official letter-designation of the grade.

ARTICLE IV.—*Cancellation of previous Administrative Order*

Administrative Order No. 25, dated February 8, 1923, and approved by the Secretary of Agriculture and Natural Resources on April 2, 1923, is hereby repealed.

This order shall take effect six months from the date of its approval by the Secretary of Agriculture and Natural Resources.

ADN. HERNANDEZ

Director of Agriculture

Approved, August 1, 1924:

SILVERIO APOSTOL

Acting Secretary of Agriculture and Natural Resources

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THE RAISING OF WRAPPER TOBACCO IN THE
COTABATO VALLEY, MINDANAO

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Certain regions of the Cotabato Valley, Cotabato Province, and the high regions surrounding the valley are well adapted for the growth and production of different classes of leaf tobacco, especially wrapper tobacco. This statement is based upon the results obtained for several years at the Pikit Tobacco Station of the Philippine Bureau of Agriculture.

The soil and the climatic conditions, which are highly favorable, make these regions of the valley good fields for the production of wrapper tobacco on a big scale.

CLIMATE

There are some variations of rainfall in the different portions of the valley due to altitudes and the condition of vegetation. Rainfall is generally greater in the high regions with mountain ranges nearby and at the lower portions of the valley than the central portion, which is mostly covered with grasses for big areas. The two tables below show the average rainfall for several years in Cotabato town, in the lower valley, and the rainfall for 1922 at Pikit in the central part of the valley.

TABLE 1.—*Mean amount of rainfall at Cotabato town*

Month	Mean in millimeter	Mean number of rainy days
January.....	98.8	12.6
February.....	88.8	10.1
March.....	68.1	7.8
April.....	164.9	12.7
May.....	218.5	14.7
June.....	237.3	17.2
July.....	292.0	18.4
August.....	271.2	18.4
September.....	248.6	16.7
October.....	255.1	15.3
November.....	231.7	15.9
December.....	133.5	13.0

Total mean amount of rainfall..... 2,309.1 mm.
Total mean number of rainy days..... 172.8
Average monthly rainfall..... 192.3 mm.

TABLE 2.—*Monthly rainfall at Pikit, in 1922*

Month	Mean in millimeter	Number of rainy days
January.....	119.5	19
February.....	68.3	7
March.....	217.8	14
April.....	275.5	10
May.....	287.7	18
June.....	213.4	18
July.....	145.1	18
August.....	91.7	11
September.....	66.3	10
October.....	263.8	17
November.....	182.2	15
December.....	60.6	15
Total amount of rainfall.....		1,631.5 mm.
Average monthly rainfall.....		135.9 mm.
Total number of rainy days.....		172

The rainfall in Pikit and in general in the Cotabato Valley varies in the monthly totals; the same month in two different years may have some variations in the total amount. The climate sometimes becomes erratic. Under normal conditions, however, the rainfall may be distributed as follows:

- Heaviest.*—May, June, July, September, and October.
- Medium.*—April, August, November, and December.
- Lightest.*—January, February, and March.

Temperature.—The temperature in the Cotabato Valley averages 26°C. during the year. The maximum temperature rarely reaches 35°C. and the minimum 20°C. In the morning and evening the temperature is pleasant, it is rather warm at noon till 3.30 p. m., when there is no rain.

The Cotabato Valley is out of the typhoon belt and is therefore free from destructive storms. There are some strong winds, generally preceding heavy rains, but not of sufficient strength to damage standing crops.

The range of relative humidity is small.

CLIMATIC CONDITIONS IN SUMATRA AND THE COTABATO VALLEY

The climatic conditions of the Cotabato Valley are similar in many respects to those of the Island of Sumatra. This similarity of climate, more than any other factor, may explain the high suitability of the Cotabato Valley for the production of tobacco wrapper. The following table shows more or less the parallel conditions prevailing in both places:

	Sumatra	Cotabato valley
Average temperature.....	27°C.....	27°C.
Maximum temperature.....	33°C.....	33°C.
Minimum temperature.....	21°C.....	21°C.
Rainfall.....	80–120 inches...	60–100 inches.
Distribution.....	Rather even....	Rather even.
Atmospheric condition.....	Humid.....	Humid.
Strong storms.....	None.....	None.
Time of rainfall.....	Mostly at p. m..	Mostly at p. m.

The Deli District situated in the northwestern part of Sumatra, where most of the plantations producing the best wrapper are located, and Cotabato Province are both north of the equator, but Cotabato is farther north by a few degrees

SOIL

Speaking of the requirements of the tobacco plant, which is very sensitive to these conditions there are different regions or zones due to the different conditions existing in the valley. While as a general proposition the soil formation of the valley is uniform, yet there are different soil conditions with reference to the soil and subsoil, generally known as the root zones of short season crops. This is of fundamental importance to the tobacco grower. Before describing in detail the type to which the soil of the valley belongs, a rough classification may be given as follows:

1. Regions that are very black and oftentimes soggy, due to the abundance of humus and low conditions. These regions may be found in the lower valley, near swamps, near the Rio Grande de Mindanao below Fort Pikit. These regions are subject to the overflow of the river and generally support talahib and other large grasses and plants that thrive in low soils. These low black bottom lands can, of course, grow fine tobacco, but due to the color of the soil, it will not produce a preponderance of light colored leaf. Moreover, the field operations in these lands are quite expensive.

2. Regions that are higher than the first class, being located in the upper reaches along the Rio Grande and its tributaries and close to the rolling country near some mountain ranges. The soil of these regions are inclined to be of light color. These lands support mostly cogon and other small grasses and second growth and virgin forests. These lands are of immediate interest to the tobacco planter.

3. Small patches of very sandy soil near the rivers. The sand may have been deposited during recent floods. Since these lands are of small areas and are generally found in the regions in the first classification, they are only of interest to the small growers.

4. Rolling country and slopes of large mountain ranges. Strictly speaking, this country does not belong to the valley, but also fine tobacco can be grown. This should be so on account of the excellent drainage, the great distance from the sea and the constituents of the soil.

Lands under the second classification are especially recommended for the growing of wrapper tobacco. It is under this

class that the following regions belong: Bual-Libuñgan section, Maridagao Valley, certain parts of the Cabacan District, part of the Banisilan region, the northern half of the Sarangani Plain, and other lesser regions of the valley that are not flooded. These lands are fairly well drained.

Lands under the fourth classification are excellent for tobacco but they are very far from the routes for the cheap transportation of the produce.

The soil in the valley is the typical alluvium of great fertility and depth. The surface soil, varying from 30 cm. to 60 cm. is a rich loamy soil with a large percentage of humus. The color is from light to deep brown.

The soil and the subsoil are free of coarse sand and stones of any kind. These are of uniform and even texture. The soil is very porous and friable. It does not retain water for a long time due to the absence of rocky stratum beneath the subsoil.

SOIL CULTIVATION

The preparation of the land for any crop in the valley varies as the vegetation of the land differs. With land supporting large grasses it is necessary that the natives with their long bolos cut these grasses and allow them to dry thoroughly including the large stems, and then burn before plowing, whether by tractor or animal power. Two plowings, one disk-harrowing and two harrowings will bring the soil of these lands into excellent tilth for tobacco. An interval of time should be allowed to elapse between plowings in order to dry out the exposed large roots, otherwise when covered in their fresh state they will soon shoot up again.

Lands supporting mostly small grasses, like cogon and allied forms (prairie grass) are ready for the tractor without the necessity of cutting. Occasional fire resistant trees growing among the cogon should be felled and stumped, so that they will not interfere with the plowing operations. With animal power, the cogon should be first rolled over, allowed to dry for some days and then burned and immediately after, plowing can be started. Two plowings and two harrowings will bring this kind of land into good condition for cropping.

With second growth and virgin forest lands, it is necessary to remove the underbush, and after being dried, should be burned. The small and large trees should be felled. If the land is needed immediately for cropping, it should be necessary to remove the stumps and these gathered and burned. As for the disposition of the logs, it is left to the manager of the plantation to decide

whether it is more expedient for him to reduce them to ashes or should be gathered for the purposes of the plantation. Depending upon the thoroughness of clearing, this class of land can be brought into excellent condition for tobacco by one or two plowings and similar number of harrowings. Generally, these lands are less weedy than the other kinds described. These lands should be preferred for tobacco.

CROPS

Tobacco culture in the Cotabato Valley is in its infancy. Only isolated small cultures are in evidence in the different regions just to supply local demand. This should not be surprising as the Cotabato Province is just in the beginning of its development. The land brought under cultivation is very small, and extensive tracts of thousands and thousands of hectares lie uncultivated, awaiting enterprising people and capital to bring them into production.

The cogon lands and those with second growth forests have been generally covered with virgin forests in the past, but are now covered with their present vegetation due to one or two croppings made by natives, and also to occasional fires. These lands have been abandoned for quite a long time. Some of these lands have been laying fallow from 5 to 150 years.

Cogon lands can be brought back to produce excellent crops in one year by deep plowing, killing all the cogon, followed by planting some leguminous crop, if possible, to be plowed under. After thorough preparation they can be planted to other crops, but the first harvest will not be very good. With lands covered with tall grasses, like talahib, they can produce at once excellent crops of tobacco without the necessity of soil renovation. The lands covered with second growth and virgin forests are in their virgin state for tobacco. These lands are superior to the others for tobacco.

SOIL CONSTITUENTS

Evidently the soil of the valley contains ammonia, phosphorus, and potash in varying amounts: NH_3 from .08 per cent to .19 per cent; P_2O_5 from .13 per cent to .18 per cent; and K_2O from .42 per cent to 1.14 per cent. The wide range of crops grown in the valley with excellent harvests point conclusively that the necessary mineral foods for the proper development of the crops must be present. The dark green foliage of most cultivated crops, the bountiful harvest, and the very white ash of the tobacco produced are good practical clues that these constituents must be present in sufficient quantities, as certain lands

in the valley have been known to be cropped, with corn and rice for example, continuously for 10 years, without a very noticeable decrease in production. Aside of natural fertility, this condition, may be due, in part to occasional floods.

FERTILIZERS

So far no fertilizer of any kind has been used for tobacco due to the great fertility of the land.

TIME OF PLANTING

Generally in the Cotabato Valley, the seed of the tobacco is sown in seedbeds in the beginning of October. The seedlings are transplanted after the middle of November. Harvesting by priming the leaves is started about the end of December and continued up to March.

HANDLING OF THE CROP

As there is no organized industry on tobacco growing on commercial proportions in the valley, the handling of the tobacco crop is primitive. Moreover, the tobacco grown is for local consumption only, generally for chewing, and it would be useless to describe the methods in growing this kind of tobacco.

The Pikit Tobacco Station of the Bureau of Agriculture, at Pikit, is the only place in the valley where tobacco is grown on a larger scale than any of the present native cultures. Brief descriptions of the methods used at the station will be given. This station handles mostly wrapper tobacco.

Seed beds.—A fertile high land is thoroughly prepared for seedbeds. The beds are made 1 meter wide by 8 meters long, running east to west. For sterilization, the soil is pan roasted. Slightly inclined framework covered with woven nipa, cogon, or other grasses are used for covering the beds. The seeds are rather thinly or thickly sown, depending whether the small seedlings will be allowed to develop in the beds, or are to be pricked into fresh beds of similar size. The seedlings are allowed to receive increasing light in the beds by removal of the cover. Ten days before transplanting the covers of the beds are entirely removed to accustom the seedlings to field conditions.

Generally, the station pricks the small seedlings to fresh beds. When the seedlings that have been thickly sown are from 15 to 25 days from sowing, they are drawn from the seedbed and are planted about 7 centimeters apart each way in new beds by women and children. These beds need not have the soil sterilized. These pricking beds are covered with slats, talahib stems

woven with bejuco, resting on level framework of bamboo. The covers admit half light and can be rolled at will, if it would be necessary to give full sunlight and during the watering of the seedlings by sprinklers.

Transplanting.—When the seedlings are from 45 to 50 days from the date of sowing, they are transplanted into the field that have been previously thoroughly prepared. Before removing the seedlings, the beds are thoroughly watered, and they are carefully removed by trowels or sharpened sticks with a ball of earth around the roots of each seedling. These seedlings are carried into the field in shallow boxes.

Planting distances.—The station grows four Sumatra strains, the Florida-Sumatra, and five hybrids varieties. The spacings found best adopted for Sumatra is 80 centimeters between the rows and 40 centimeters between the plants in the row. With Florida-Sumatra, having larger leaves than the Sumatra, the spacing between the rows is from 90 to 100 centimeters and 50 centimeters between the plants.

The furrows are laid in two ways: (1) By wooden markers. When the ground is dry at transplanting time, this method is availed of. Holes are dug for the young plants; a tumbler of water is poured into each hole before setting the plant. (2) By light plows. This is resorted to when the ground is wet or when it is raining, and there is no need of watering. With the plow furrows are opened just before transplanting, in order to prevent the evaporation of the necessary moisture for the young plants. This is a very rapid and cheap way of transplanting.

Cultivation.—The tobacco field should be absolutely clean of weeds and in the best of tilth during the development of the plants. Cultivation is started as soon as the plants get well established and is frequently repeated until it is no longer possible to do so on account of the large size of the plants which interfere with the operation. Ridging the rows at the station is done by means of cultivators. The soil between the rows is first stirred with cultivators having small teeth. This is followed by another cultivator with large shovel-like side teeth. This series of cultivations is repeated three times, and the large teeth at the sides of the second cultivator gradually ridge the rows, so that in the end the rows stand on fairly high ridges. The ridges protect the plants from excessive rains and provide larger feeding area for the roots.

Topping and suckering.—As a rule the plants of the station are topped. The flower heads are allowed to develop before they

are completely removed. This topping is not done to include some of the top leaves. After topping the plants produce axillary shoots and suckers. These are completely removed by pinching with the fingers.

Picking worms.—In the seedbeds worms appear to destroy the leaves. At the station the worms are removed by women or sometimes the plants are sprayed with 1 per cent solution of arsenate of lead.

In the field the picking of worms is invariably done by women early in the morning and late in the afternoon, when the worms are actively eating the leaves.

Harvest.—Harvest of the leaves is always done by priming; i. e. by removing the leaves as they ripen. Early in the morning the leaves are wet with dew and on account of this condition harvest are always carried out late in the morning or beginning at 1 p. m. Ripe leaves can be recognized by a noticeable change of color to lighter green, by yellow specks at the tips and other parts, and by swollen and rough appearance. For wrapper tobacco the leaves should be picked before they become very mature. This is important. The harvest leaves should be always protected from unnecessary exposure to the hot sun.

Curing.—The leaves are carried in baskets to the curing shed, 14 meters long, 7 meters wide and 4 meters to the eaves, and with swinging walls of *salangui*. The leaves are arranged perpendicularly with tips up on the floor of the shed with *salangui* spread on the ground, in order not to have the leaves touch the ground. The next day when the leaves are sufficiently wilted for handling, they are strung by means of gunny sack needles and twine or fibers of *bago*. Two ways are practised in stringing the leaves: (1) The leaves are strung through the petioles and arranged in such a way that the midribs are exposed on both sides and the leaf blades are turned in. The leaves are made to ride alternately on poles 2.5 meters long. (2) The petioles are pierced by the needle, so that the leaves are face to face and back to back. With this method of stringing, the poles used are about $1\frac{1}{2}$ meters long. The two ends of the string or twine are securely tied at the two ends of the pole, so that the strung leaves just hang and are not made to ride on the pole as the first method. The sagging of the string due to the heavy weight of green leaves can be prevented by tying the string at intermediate points at the pole. The second method is generally used in Sumatra and Cuba.

The swinging walls of the shed are managed in order to admit or exclude, as the leaves in process of curing require, the neces-

sary light, air, and moisture for slow curing, in order to fix in the leaves the desired color and quality. The management of the curing shed requires experience and it is needless to give set rules. The leaves are considered cured when the midribs are thoroughly dry, necessitating for this process from 18 to 25 days.

The cured leaves are detached from the poles, are brought closer together in the middle of the string, both ends of which are tied, making a loose bundle. The removal of the leaves from the poles is always done in the morning when the leaves have sufficient moisture acquired during the previous evening. The cured leaves are brought to the bodega for fermentation.

Fermentation.—The cured tobacco is piled in small bulks at first, in the case of the station a bulk may represent the harvest from one experiment. The temperature of these small *mandalas* is allowed to reach 38°C. when they should be rebuilt, in order to give even fermentation of the inside and outside bunches. These small *mandalas* are combined to make up one large *mandala*, 3 meters long by 2 meters wide and 1½ meters high. The mandala could be increased in its dimensions to advantage, but the yearly harvest of from 2,000 to 3,000 kilos of the station is not of sufficient quantity to make a larger mandala.

The large mandala should be built carefully so that it will have even dimensions at the top and at the bottom. The bunches of leaves are so arranged that the tips are inside and the petioles pointing outward. The *manos* should be arranged in even layers from outside to the center. In order to have the leaves touch each other, heavy boards are placed periodically on top of the mandala.

A bamboo tube, with slits and the divisions removed, is placed horizontally in the middle of the mandala with the end out for inserting a thermometer, which is the only guide for this important process. The end of the bamboo where the thermometer is inserted should be corked or covered, so that the air in the tube should have the same temperature as that of the mandala.

The whole pile of tobacco should be covered with mats or canvass.

The thermometer should be read twice or thrice a day, depending upon the rise of the temperature. The readings should be recorded in a card tied to the mandala.

The temperature should rise gradually and when it reaches 42°C. the mandala is rebuilt and the hands shaken out. At the rebuilding of the pile the bunches of the leaves that were inside are placed outside and vice versa. The pile is rebuilt several

times, each mandala giving a rise of 4 degrees over the temperature of the previous one, that is, at 46°C., 50°C., and the last rebuilt mandala should reach 53°C. For practical purposes 53 degrees temperature is enough. Sometimes the condition of some tobacco requires a higher temperature in order to complete the fermentation, but for wrapper it should never exceed 55°C.

Fermentation may require from 3 weeks to one month.

Sorting.—After fermentation the leaves are sorted into four classes: (1) wrappers, (2) binders, (3) fillers, and (4) inferior (trash). The wrappers are classified further according to three principal colors: claro, colorado claro, and colorado. These grades are also separated into class sizes as required by Internal Revenue regulations. The binders and fillers are also separated into class sizes.

SUMMARY

From the above description, the following very necessary requisites for successful wrapper production, with right conditions of climate and soil assumed, may be briefly stated:

1. A very rapid uninterrupted growth of the plants.
2. Uniform stand of crop in the field in order to provide the necessary intershading of the leaves.
3. Planting at close distances for the production of fine leaves. Fineness rather than size is the prime consideration.
4. Absence of spots or specks caused by diseases and destruction caused by worms and insects. Wrapper leaves should be sound and whole.
5. Proper curing, and controlled fermentation by the thermometer.
6. Proper classification of leaves into classes and grade.
7. The conscientious attention to all details incident to production.

A PRELIMINARY REPORT ON THE EFFECT OF DISTANCES OF PLANTING WRAPPER TOBACCO

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GENERAL CONSIDERATIONS

One of the main reasons which prompted the Government to establish a tobacco experiment station at Isabela Province in 1916, was to undertake wrapper tests in an attempt to check if possible the ever-increasing importation into the Islands of wrappers from the Dutch East Indies and the United States. The undertaking naturally fell under the following five lines of activities:

1. Acclimatization of recognized strains, e. g., Florida-Sumatra and Havanensis.
2. Selection of desirable strains from the heterogenous local stocks.
3. Hybridization to get desirable combinations either among the native strains or between native and foreign strains.
4. Consistent cultural methods, e. g., shorter spacing, partial artificial shading, early harvesting, etc.
5. Methods of curing tobacco.

The results obtained until the year 1920, have been rather so irregular, that is, while the technique followed has been as uniform as possible, no two seasons ever furnished the same results. It was this fact that prompted the Bureau of Agriculture to realize that perhaps the climatic conditions must have a considerable influence on the culture as have been asserted to and conclusively demonstrated by leading authorities with respect to tobacco in particular. Whitney of the United States Department of Agriculture concluded thus, "The plant is far more sensitive to these meteorological conditions than are our instruments." Obviously climatic and soil conditions jointly and primarily determine whether a locality or region is suitable for the raising of wrapper tobacco. But irregular results were obtained at the Dammas Tobacco Station in Isabela Province during the first five years of its existence notwith-

standing the fact that in the station are some choice rich sandy alluvial soils. Hence, the only important factor which remained questionable was that of climate.

If we should consider the climate of Sumatra as the standard for wrapper tobacco production, by comparing the climates of Isabela and Cotabato respectively with it, we would find that there is a remarkable similarity between the climates of Sumatra and Cotabato, whereas that of Isabela is so different. (See Table I.)

TABLE I.—Records of temperature and rainfall of some tobacco regions

Regions	Isabela	Cotabato	Sumatra
Temperature:	°C.	°C.	°C.
Means of annual minimum.....	15.2	20	21
Means of annual normal.....	26.7	26	27
Means of annual maximum.....	38.9	35	33
Annual range.....	5.5	1.4	(Very uniform)
Rainfall:	mm.	mm.	mm.
Mean of annual rainfall.....	1,683.0	2,272.1	2,540.0

Another climatic advantage of Cotabato over Isabela is that it is virtually outside of the typhoon belt. The records of the Weather Bureau show that during the period of 1903 to 1918, the percentage of remarkable typhoons for Cotabato was 0; Isabela, 21.5 and Cagayan, 35.0.

In view of the above considerations together with the alluvial well-drained soils which abound in the Cotabato Valley, the Bureau of Agriculture took the only logical step by establishing in 1920 in this region, a tobacco experiment station at Pikit, to coöperate with the Dammao Tobacco Station. That this step is justified although the station has only been under operation during three years, is evident from encouraging testimonials received from some of the leading Manila cigar manufacturers regarding the qualities of wrapper samples produced in Cotabato and submitted to them.

MOST SUCCESSFUL WRAPPER TEST IN COTABATO

Because of the considerable young existence of the Pikit Tobacco Station, the results that can be presented, are naturally from cultures of already definitely established or pedigreed strains or varieties whose purity has been maintained at the station by rigid in breeding, generation after generation. Thus, the test that so far has given the most satisfactory results along the production of wrappers, is the acclimatization of the foreign varieties, 14 Baker's Sumatra and 1 Sumatra-Florida planted in suitable close distance. And for the benefit of those

planters who are particularly interested in the Philippine cigar tobacco industry, the results obtained during the season of 1922-1923, are being presented in this paper in the form of a preliminary report.

CHARACTERISTIC FEATURES OF THE VARIETIES USED

There is no marked morphological difference between the 14 Baker's Sumatra and the 1 Florida-Sumatra except that the latter seems to be more prolific. Consequently, both may be considered as strains or subvarieties only of the characteristic variety, Sumatra. The chief characteristics of this variety are its round-pointed, erect leaves with a very high breadth index which is generally between 50 and 60 per centum. The number of leaves averages from 26 to 28. The average height is about 6 feet when grown in the open at closer distances. All things being equal, this variety produces the greatest percentage of wrappers.

14 Baker's Sumatra was introduced into the station as first acclimatized at the Dammao Tobacco Station, Isabela, by Dean C. F. Baker of the College of Agriculture, Los Baños and Florida-Sumatra, by the Bureau of Agriculture, Manila.

PLAN OF CULTURES

A field was selected which was as uniform as possible with regard to topography and physical characteristics. It was equally divided into two parts in order that the culture for each strain should be an exact duplicate of the other. (See text figure No. 1.) Each part was divided in turn into five plots which were numbered consecutively from 1 to 5 for the 14 Baker's Sumatra lot or Lot No. 1 and from 6 to 10 for the 1 Florida-Sumatra lot or Lot No. 2. The areas of the plots were as follows:

Plots	Square meters
1 and 6	588.00
2 and 7	579.00
3 and 8	560.00
4 and 9	509.60
5 and 10	1,102.10

The distance between the rows for each pair of plots were made thus:

Plots	Centimeters
1 and 6	100
2 and 7	90
3 and 8	80
4 and 9	70
5 and 10	80

With the exception of Plots 5 and 10 in which the plants were set out 40 centimeters apart in the rows, in every plot, the distance between the plants in the rows was uniformly 50 centimeters.

As may be seen from the above spacing the five distance combinations used in the experiment were 100 x 50, 90 x 50, 80 x 50, 70 x 50, and 80 x 40 centimeters, respectively.

14 BAKER'S SUMATRA LOT OR LOT No. 1

PLOT 1	PLOT 2	PLOT 3	PLOT 4	PLOT 5
100×50 cm.	90×50 cm.	80×50 cm.	70×50 cm.	80×40 cm.

PATH 2 METERS WIDE

PLOT 6	PLOT 7	PLOT 8	PLOT 9	PLOT 10
100×50 cm.	90×50 cm.	80×50 cm.	70×50 cm.	80×40 cm.

1 FLORIDA-SUMATRA LOT OR LOT No. 2

FIG. 1. Sketch of field showing arrangement of lots and divisional plots and the strains of commercial tobacco planted and distance combinations.

FIELD SUMMARY OF OPERATIONS AND CURING AND FERMENTING PROCESSES CONDUCTED

Transplanting was done in November, 1922, a little over two months after sowing. As at Dammas, the newly-transplanted seedlings were protected from the hot sun with coverings of convenient banana sheath cuts. The young plants were first mulched by loosening the soil around them with trowels. The field was cultivated actually only once. Suckering was rigidly observed but topping was dispensed with in order to insure greater inter-shading of the plants and also to determine the maximum development attained by the plants in different distances of planting. Harvesting was carried on only by priming and the leaves harvested were poled Cuban-fashion, being

strung with the fiber of a malvaceous shrub locally called "bago-bago." Curing was allowed to take place wholly in the shed or barn and the cured leaves were subjected to the ordinary, simple bulk fermentation.

EFFECT OF DISTANCES ON THE CROP AS A WHOLE

Physiological considerations.—Obviously the effect of close planting is to reduce the activity of photosynthesis as in the use of chees-cloth tents, in order that the leaves in the first place, may not develop thick in texture as the result of the relative reduction of the supply of carbohydrates. Indeed, it is not presumed in this connection that the effect of the shade furnished by the cheese-cloth tent is the same as that which is the result of close planting because, in the first place the intensity of light is not so well regulated in the latter. But one thing is common between the two. And that is, the considerable reduction of the amount of light actually received by the leaves, which, while it is true for all the leaves of plants in the tent, it is only effective for the lower leaves of plants grown in the open, no matter how closely they are set out in the fields. The problem of the tent user consists only in the right mesh of cloth but the open grower must determine the spacings and the choice of the right strain or strains.

Other physiological phenomena observed in connection with the effect of shading on the tobacco plant in particular are those with respect to absorption and transpiration. Stutzer and Goy(1914) observed that tobacco grown under controlled conditions produced a large percentage of nicotine and high potassium but low chlorin content as the result of abundant sunlight, liberal nitrogeneous manuring, and sparing use of water in the soil. Hasselbring(1915) while connected with the Cuban Experiment Station in the winter of 1908, observed that tobacco plants grown in the open absorbed about 30 per centum more water than those grown under shade. The plants which absorbed and transpired the greater quantity of water contained the smaller percentage and the smaller absolute quantity of ash. It appears from these observations that the absorption of salts by roots is independent of the absorption of water and that the transpiration stream does not exert an accelerating effect on the entrance of salts.

Effect of distances on the development of the leaves.—Observations on the development of the leaves were grossly made and are presented below in tabular form (Table II).

TABLE II.—*Effect of different distances of planting on the development of the leaves*

Distance combinations	Strains	Gross effect on the development of the leaves
100×50 centimeters.	{ 14 Baker's Sumatra.	Coarse, thick, gummy, and dark.
	{ 1 Florida-Sumatra.	Do.
90×50 centimeters.	{ 14 Baker's Sumatra.	Do.
	{ 1 Florida-Sumatra.	Do.
80×50 centimeters.	{ 14 Baker's Sumatra.	Smooth, thin, less gummy, and light.
	{ 1 Florida-Sumatra.	Development as a whole, poor.
70×50 centimeters.	{ 14 Baker's Sumatra.	Do.
	{ 1 Florida-Sumatra.	Do.
80×40 centimeters.	{ 14 Baker's Sumatra.	Smooth, thin, less gummy, and light.
	{ 1 Florida-Sumatra.	Development as a whole, poor.

The classification of the sound leaves into wrappers and fillers was based on prevailing market standards irrespective of size. All leaves of uniform color, small veined, fine textured, elastic and pliable were considered wrappers. The rest of the leaves that were not fine textured enough but of good aroma and burn were considered fillers.

The following table shows the actual yield in fillers and wrappers.

TABLE III.—*Effect of different distances of planting on the quality of the leaves*

Distance combinations	Strains	Amount of wrappers	Amount of fillers	Total yield	Percentage of wrappers ^a
		<i>Kilos</i>	<i>Kilos</i>	<i>Kilos</i>	
100×50 centimeters.	{ 14 Baker's Sumatra.	15.50	42.50	58.00	26.7
	{ 1 Florida-Sumatra.	16.50	48.50	65.00	24.6
90×50 centimeters.	{ 14 Baker's Sumatra.	17.00	39.50	56.50	30.1
	{ 1 Florida-Sumatra.	18.50	43.50	62.00	29.8
80×50 centimeters.	{ 14 Baker's Sumatra.	20.00	29.00	49.00	40.8
	{ 1 Florida-Sumatra.	16.00	42.00	58.00	27.5
70×50 centimeters.	{ 14 Baker's Sumatra.	12.50	20.50	33.00	37.8
	{ 1 Florida-Sumatra.	12.50	35.00	47.50	26.3
80×40 centimeters.	{ 14 Baker's Sumatra.	40.50	55.50	96.00	42.2
	{ 1 Florida-Sumatra.	20.00	45.50	65.50	26.5

^a Smooth, thin, less gummy, and light

Influence of distances on the prevalence and nature of diseases and insect pests.—During the season the important diseases and insect pests observed were leaf-spots of various forms, the common cut worms and plant lice. As naturally would be expected, the greatest infection by the diseases and attacks by the insects took place in the lots of closer distances of planting. The inevitable contact of the leaves as well as their reduced vegetative vigor indeed made them not only susceptible or favorable to the dissemination of the pathogenes but also preferred by the insects for being softer and less gummy, they were more palatable.

CONCLUSIONS AND RECOMMENDATIONS

Complete conclusions and recommendations to be derived from the observations and results just presented, obviously, cannot be emphasized inasmuch as it has been assured in the early part of this paper that this report is but preliminary. However, as the reader must have become aware of already, the following noteworthy facts have been quite well established for the strains, Baker's Sumatra and Florida-Sumatra under climatic and soil conditions typical of the Cotabato Valley:

1. Of the two strains tested, the 14 Baker-Sumatra is more adaptable in the production of wrapper than 1 Florida-Sumatra.
2. The best distance combination for 1 Baker-Sumatra is either 80 x 50 or 80 x 40 centimeters.
3. While 1 Florida-Sumatra does not produce as great a percentage of wrappers as the 14 Baker-Sumatra, its production is nevertheless quite fair when planted 90 x 50 centimeters.
4. If sufficient inducement could be obtained from interested representatives of important cigar factories in Manila, there is no reason why, the production of wrappers in a bigger scale could not be adequately encouraged in the Cotabato Valley.

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COÖPERATIVE MARKETING AS A FACTOR IN IMPROVING OUR AGRICULTURAL CONDITIONS

By JOSE S. CAMUS

Acting Chief, Agricultural Extension Division

While every effort is exerted in developing our agriculture by increasing our production, the writer believes that the desired result can not be obtained unless the farmers learn the methods of handling their products properly for the market through systematic coöperative marketing. A good farmer must not only know the best methods of farming; such as the proper preparation of the land, seed selection, crop rotation, the control and eradication of pests and diseases, but must also know the standardization of his products, as well as its proper packing and shipping before putting them on the market so that they may command a good price.

Our farmers today do not receive the full money value of their crops and find farming unprofitable for lack of systematic coöperative marketing. The introduction of this system into our farming activities would improve our agriculture in general, and would save our farmers from the usurers and speculators. Some farmers, especially those living in distant provinces, plant crops that will only supply home demand because they find it unprofitable to plant them in a large scale for lack of a good market, and, if there is any market at all, the price will not cover the cost of production and transportation. The marketing expenses, however, can be minimized if the farmers will only group themselves and sell together their farm produce at regulated prices.

Thus, while it is important that our farming methods should be developed, it is equally necessary that the marketing side be improved in order that the farmers may get the full money value of their crops.

Although the organization for coöperative marketing is comparatively recent in the Philippines, there is no doubt that it can be carried out here successfully as in other countries. It may take time, however, before good results can be obtained but it will not take long before our farmers will see its value.

COÖPERATIVE ORGANIZATIONS ABROAD

The first agricultural coöperative organization formed was in Denmark, organized in the year 1860, with the object of improving the livestock and grain industry in that country. That organization, though of a different type from that of the present agricultural coöperative organizations, served its purpose, for the interest of the farmers was better taken care of and a great deal of work was done in improving farm seeds by producing better strains of plants and making these improved seeds available to the members of the society. Originally, it was composed of small farmers but later on the big wealthy landowners in Denmark joined the organization when they realized the value of coöperation in solving their agricultural problems. Because of this movement much was accomplished in increasing production and in suppressing monopolies which existed in that country.

The work of developing agriculture through coöperative work among the farmers is being done more or less successfully in almost every country in Europe, in India, and in the United States. In the countries mentioned above there are but a few coöperative producers' associations at present that can be considered really successful. It is only in 1895 that the agricultural coöperative organization became an important factor in the United States in improving agriculture. One of the earliest coöperative marketing associations organized in that country was the Cranberry Growers' Association of New Jersey and Massachusetts. This association was not wholly coöperative as the product was sold separately and the returns were made to each member, on the basis of the sale of his individual crop. The products were sold under the brand of the individual grower and not of the association. After a few years this method proved to be wholly unsatisfactory, and so the members decided to form a central agency, known as the National Fruit Company, which handled all the products of the member under the company's name.

At present the most successful work in coöperative marketing in the United States is found on the Pacific Coast among the fruit growers of California, Washington, and Oregon. At the beginning the farmers found out that the method of marketing their crop was a very complex business because of the nature of the fruits, which is perishable. It was then impossible to distribute them to all parts of the United States and to export them to foreign countries. As the fruits produced varied in quality, the associaton took charge of standardizing the fruits handled

and of packing and shipping them. By this process, grade and quality of the produce were assured and the association established a reputation. Later on a number of these local associations of growers grouped themselves into a central organization to handle their business on a more extensive scale. These organizations helped materially and were responsible for the success of the fruit industry in the United States today.

In 1914, an agricultural marketing society was organized in Burma to sell rice and peanuts direct to the wholesale dealers in Rangoon. The exporters protested to the Government of India claiming that the organized coöperative society had raised the prices of the products and as a result the merchants and consumers suffered. The committee assigned to investigate could not find any evidence to support the merchants' charges and the Government did not take further action. Due to the organization, unnecessary middlemen were eliminated and a better understanding between the wholesale dealers and the producers in India was established.

COÖPERATIVE ORGANIZATIONS IN THE PHILIPPINES

In the Philippines coöperation in various forms is part of the scheme of the work of our farmers, yet no efficient systematic organization on coöperative marketing was ever attempted until 1913 when work in this direction was started by the Bureau of Agriculture. Before this work was begun, the Director of Agriculture sent out letters to all provincial governors to find out what has been done along this line. From the replies received it appeared that no organization of this kind existed in the Islands except two of a quasi-coöperative character found in Bulacan Province, one operating a rice mill and another operating a rice-threshing machine. The societies were both composed of farmers who put up these machines for milling their own rice and those of others, charging some money or palay for milling.

Another association found was the Davao Planters' Association organized to foster and stimulate the cultivation of hemp in that province and to defend the interest of its members.

In July, 1914, an office of coöperative organization was created in the Bureau of Agriculture to induce the farmers to group together in order to better their conditions, and to pave the way for the solution of their marketing problems.

Ex-Vice-Governor Martin during his administration started the movement. The initial work done was the organization of municipal and provincial agricultural societies. It was planned

to have insular and provincial agricultural councils to look after the staple products such as abaca, tobacco, coconut, sugar and rice, and to organize the farmers according to their products. It was expected that through the organization of these coöperative agricultural societies the products of the members could be marketed coöperatively.

The support of the provincial and municipal authorities, the Constabulary and the schools, were secured in fostering this plan, and as a result there were 200 municipal agricultural societies organized by the Bureau of Agriculture in 22 provinces with a total membership of 15,000 in 1914 and a total of 286 municipal agricultural societies in the 29 provinces at the close of 1918.

Of these associations but a few succeeded to come up to expectations. Among the municipal agricultural societies organized, the one in Pañgil, Laguna, which has conducted coöperative marketing successfully, is worth mentioning. This society started with small capital and gradually built up a fund amounting to ₱1,100. The members started the enterprise by buying the coconuts produced by the members and sold them direct to the wholesale dealers in Manila. Other societies which attained a similar success are the municipal agricultural society in Lumbang, Laguna and that in San Antonio, Zambales.

CHAMBERS OF AGRICULTURE

In 1922, at the convention held in Manila during the Carnival by the provincial governors, the presidents of the Agricultural Congress and of the Philippine Chamber of Agriculture, and the Secretary of Agriculture and Natural Resources, it was agreed upon to organize in the provinces, provincial and municipal chambers of agriculture in order to develop among the farmers a simple coöperative system of buying and selling their products and placing them on the market with the least possible intervention of the middlemen and the speculators.

PRODUCERS' ASSOCIATIONS

This plan was carried out in some provinces but the results obtained were not promising and so in April, 1922, another campaign was started to organize producers' coöperative marketing organizations, composed of farmers producing the same kind of crop only such as banana planters, vegetable raisers, poultry raisers, mango growers, tobacco producers, milk producers, etc. This plan was considered better than the previous ones for as the members produce the same kind of crops the association

can handle the business better and the members will have one common interest.

At the start many difficulties were encountered in organizing these producers' associations and pessimism prevailed in some quarters because of the sad experiences of the people due to the mismanagement and abuse committed by officers and other members of previous organizations. The middlemen capitalized these failures and opposed the new organization, but in spite of these difficulties, thirty local coöperative producers' associations were organized in 1923 by the Bureau of Agriculture.

Efforts were also made by the Bureau of Agriculture to enable these associations to market their products direct to Manila. To start with, a central milk agency was established in the city which handled the products of four milk producers' associations in the provinces. Later on the Rizal Farm Mercantile Coöperative Association of Caloocan, Rizal, has also established an agency in Manila. Another milk agency was established in San Fernando, Pampanga, by the Pampanga Milk Producers' Association where milk prepared in a sanitary way was handled locally in a commercial scale.

The products of the Banana and Papaya Growers' Associations, however, were sold to the Manila Fruit Company and the National Fruit Company established in the city, as well as to other dealers.

The only Tobacco Coöperative Producers' Association so far organized by the Bureau of Agriculture is the one in Nemmatan, Jones, Isabela. This association will handle the tobacco crop of its members. The adoption of better methods of culture and better handling of tobacco are among the helpful activities of the association.

The Bureau of Commerce and Industry is also working along this line, and has so far, according to information, organized a tobacco association in Tuguegarao. With the combined efforts of these two bureaus and the coöperation of the Bureau of Internal Revenue, more of these associations can be established in the Cagayan Valley which may be depended upon to solve the present tobacco problems.

Under the present method of marketing there is absolutely no incentive for the planters to produce better crop. The buying and selling of unstandardized products is not conducive to the production of better crop, as no better price is paid by the tobacco buyers for quality.

The tobacco crop passes through many hands before it reaches the manufacturer or exporter. As a consequence, the compensation of the intermediaries is added to the price of the product. Their elimination through coöperative marketing organization will, it is believed, redound to the benefit of the planters and the exporters, as the former will get the full value of their product, and the latter will pay a reduced price for the reason that they will not employ too many buyers as they do at the present time.

CONCLUSION

There is no reason why coöperative marketing cannot be developed in this country as with the development of coöperative marketing the farmers will undoubtedly get better price and will be able to dispose of their product more easily. They will also learn the standardization of the produce as to kind and quality; the proper distribution thereof to the market; the regulation of its supply and the proper method of selling and advertising, all of which are still not known to our farmers.

In the work of coöperative marketing three things can be demonstrated. First, agricultural coöperative marketing association creates a community spirit in any line they want to undertake; second, it serves as an important factor and as a medium in promoting agricultural interest in any province or municipality by increased production and by the standardization of products for the market; third, the success and failure of each association primarily depend upon the kind of management coupled with facilities.

Much has been said and written on the advantages of organizing coöperative associations with an encouraging, instructive and convincing suggestions. People read and realize all these advantages, but when they are put into practice it is suprising to meet so many obstacles and difficulties in persuading farmers to engage on this profitable way of doing business.

A noted economist has said: "Of all the classes of society the farmers are the most easily divided, the most reluctant to stand together for their common defense and the promotion of their common interest."

So far as I have observed, the following are some of the obstacles which cause failures in coöperative marketing work in this country:

1. The ignorance of proper method of marketing the product as a limiting factor in the dissemination of the value of coöperative marketing organization.

2. The lack of business ability of the officers and frequent and systematic supervision and auditing of the accounts of the association.

3. The lack of economy as a cause of failures of coöperative organizations, especially those just starting. Oftentimes the officers forget to exercise all economy possible that what little income the association may gain is also lost. It is very essential for any young association that its expenses do not exceed the income.

4. The general weakness of the coöperative spirit and loyalty of the members to support the society. Every member exercises his individuality, feels independent and in cases where societies exist, the members do not look upon themselves in any other light than to throw his advantage and competition with each other in securing personal interest to the society.

5. *Opposition.*—The question of opposition is closely allied to that of loyalty; for while loyalty is maintained opposition is ineffective.

PROGRESS REPORT ON FIVE NEW HYBRID VARIETIES OF TOBACCO

By M. E. GUTIERREZ
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Along with the main work at the Pikit Tobacco Station on the production of wrapper tobacco, hybridization was carried on in the early part of 1922. For fine wrapper tobacco the station obtained indifferent results with native varieties, mostly introduced from the Cagayan Valley and with those imported from cool countries, with the notable exception of the Florida Sumatra. Most of the leaves of this variety were not even suitable for wrappers, except when the plants were grown in the shade.

In the season of 1921-22, Sumatra seed furnished by Dean C. F. Baker of the College of Agriculture, Los Baños, Laguna, was planted at the station. Although the seed was recently introduced on account of the promising appearance of the plants in the field and their remarkable growth, it was expected that this variety would produce fine wrapper leaves. With the already acclimatized varieties and with the Sumatra, the station had the materials to start some preliminary hybridization work, using the Sumatra to improve our varieties that did not give the desired results in the production of wrapper leaves. It was not thought advisable to cross native varieties with each other or with the varieties from cool countries, because repeated cultures of these varieties showed that all the unit wrapper characters were not exhibited by them. This is not surprising, as tobacco is a plant which is highly responsive to climatic and soil conditions, notwithstanding the fact that some of the imported varieties may produce excellent wrapper leaves in the countries of origin.

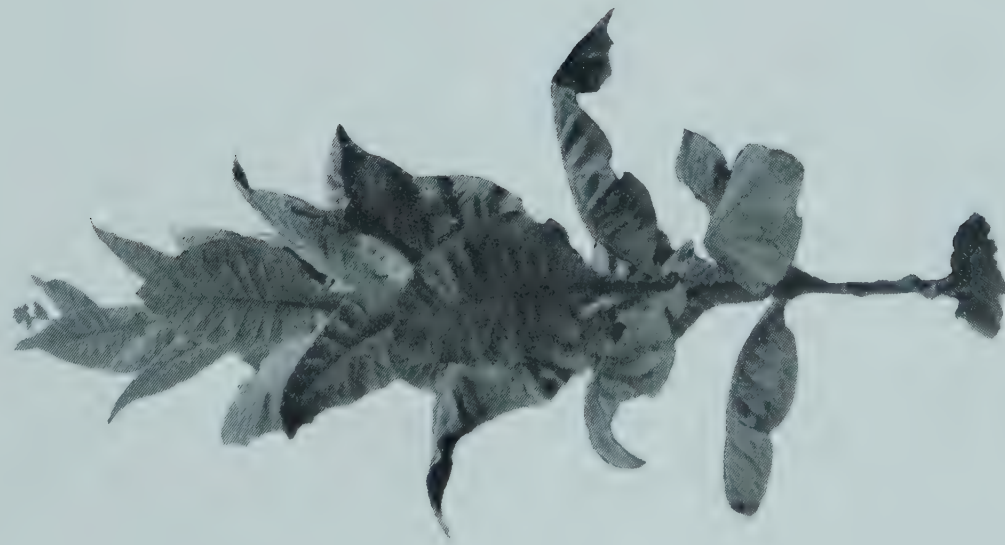
The choice of the newly introduced Sumatra used for improving the station varieties was well made, as at the close of the season it produced fine wrapper leaves both in the open and in the shade. The lower standard leaves produced fine *claro* color, in spite of the fact that the soil in Pikit is too black for the production of light colored wrappers. Moreover, subsequent cultures of this variety showed that it is less susceptible

to fungus diseases, does not sucker freely, and can withstand adverse conditions of weather better than the other varieties grown at the station. The position of the leaves, being erect with the tips slightly drooping, is one of its advantages over the others, as this protects the leaves from receiving directly the rays of the sun. This unit wrapper character is distinctly conclusive that fine textured leaves can be produced.

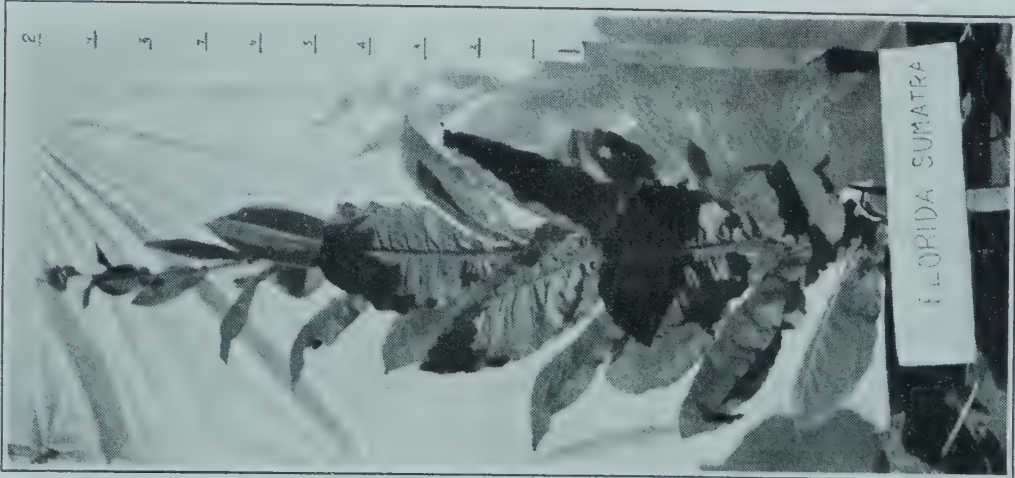
It would not be amiss to give a few remarks regarding the station varieties that needed improvement, as from these it will be understood why it was necessary to resort to hybridization in order to ameliorate said varieties.

1. *Florida-Sumatra*.—This variety introduced by the Bureau of Agriculture in 1919 was planted for three successive seasons at the station, beginning in 1920. The plants are very stocky with large broad close-set leaves with blunt tips. The leaves being almost elliptical in shape are desirable for wrapper. The leaves being larger than those of the Sumatra, have coarser veins, but each leaf yields more cigar wrappers. Under Pikit conditions the leaves produced are generally between *colorado claro* and *colorado* in color after curing. The cured leaves have an agreeable aroma. It may be used for two purposes; namely, for wrapper and for filler. Its principal defects are its coarse veins, its free suckering habit, easy susceptibility to diseases and insect pests, and sensitiveness to adverse environmental conditions. A Florida-Sumatra plant from a selected strain, the result of 3 seasons' work of inbreeding is shown in figure Plate 1 (b).

2. *Dammao Broadleaf*.—This variety came from Dammao Tobacco Station in Isabela and was introduced in Pikit in 1920. It was subjected to the best cultural treatment in the open for the production of wrapper leaves, but only a small percentage of leaves produced were suitable for this purpose. The fermented leaves were more suitable for binders and fillers than for wrappers. This variety was affected by chlorosis, a physiological disease; but strain 2F₂—6 was isolated which was resistant to that disease. The best plants from this strain were used for hybridization. The leaves, are large and broad, but have very coarse veins, and the surface of the leaves is very wavy. Due to the defective position of the large leaves, being drooping with the tips of the lower standard leaves almost flush with the ground and with the resultant close overlapping, preventing proper aëration, the leaves are easily affected by fungus diseases.



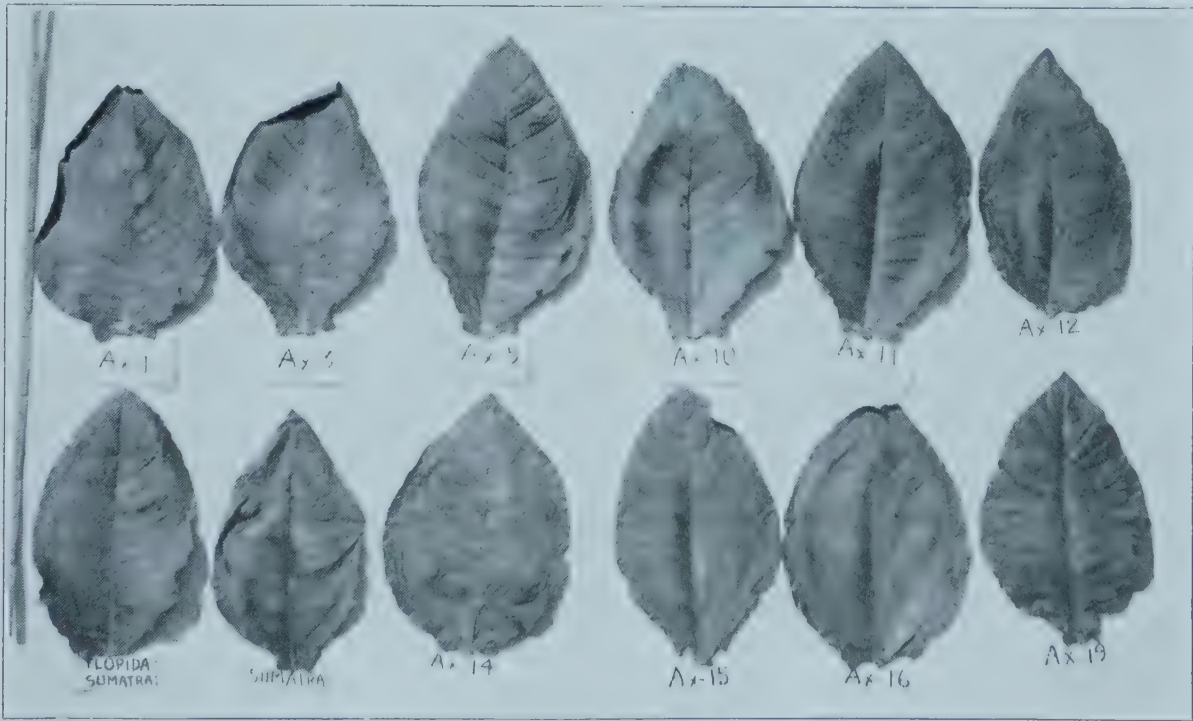
(a) Baker's Sumatra



(b) Florida Sumatra, the result of three generations of in breeding



(a) Plant-to-the-row test with the Baker's Sumatra X Florida-Sumatra (Ax—hybrid)



(b) Shapes of leaves of the different strains of Baker's Sumatra X Florida-Sumatra

6. *Connecticut Broadleaf*.—Due to the rather warm climate at Pikit or to the character of its soil or both conditions combined, this variety produced very thick, dark colored leaves with rather coarse veins, rather long and oblong in shape and altogether unsuitable for wrapper. Under the conditions at Pikit wrapper leaves could not be produced from this variety.

13. *Havana*.—This variety introduced into the Philippines from Cuba was sent in 1920 to the station by the Central Office of the Bureau of Agriculture. This is the tobacco that made Cuba famous and is now everywhere grown in that island. Havana variety in its native home produces the three classes of leaves required by the factory in the manufacture of cigars; namely, wrappers, binders, and fillers. But at this station after three successive seasonal trials covering a period of three years it did not produce good wrapper leaves. The leaves were rather small, thick, and of bright brown color, very suitable for fillers but certainly not fit for wrappers. The variety as cultured at this station answers the description of Paguirigan as published in Vol. 16 (1923), No. 3, page 175 of the "Philippine Agricultural Review."

The object of this hybridization work was to get a combination of desirable wrapper characters, most of which were well exhibited by the Sumatra varieties as grown under the climatic and soil conditions at Pikit. The other varieties did not show these wrapper characters but only to a limited extent.

At the early part of 1922 the writer made the following crosses:

- 14 Sumatra X 1F₁—2 Florida-Sumatra.
- 1F₁—6 Florida-Sumatra X 14 Sumatra.
- 2F₁—6 Dammao Broadleaf X 14 Sumatra.
- 6F₁—2 Connecticut Broadleaf X 14 Sumatra.
- 13 Havana X 14 Sumatra.

The first number is the number as given to the original seed received and entered into our accession book; the number after the dash is the strain number.

With the exception of the first cross, the Sumatra was used as the male or staminate parent, because in tobacco hybridization "the physical characters of the staminate parents are generally dominant over those of the pistillate."¹ As stated in the beginning of this paper, the intention in this hybridization work was to have the four varieties improved in the di-

¹ Tirona, The Philippine Agriculturist and Forester, Vol. 3 (1914), No. 1, p. 7.

rection of wrapper production by the infusion of the Sumatra "blood."

In the season of 1922-23 the hybrid tobacco seed resulting from the cross were planted in small plots. The plants grew vigorously. From this F_1 hybrid generation, selections and in-breeding of the best mother plants were made by the writer, for plant-to-the-row tests, in order to isolate in the F_2 generation a number of strains having the most desirable types for the production of wrapper leaves. During the 1923-24 season this work was in progress. The result of this hybridization work combined with selection will be published in a separate paper. The F_2 generation furnished the data for the present descriptions.

The present cultures of these five hybrids show that they have certain advantages over their parents in luxuriance, vigor, earliness, size of leaves, rapidity of growth and other important characters. In this respect they are distinct improvements. For this reason and in order to acquaint the readers with these new hybrid tobacco varieties, the detailed botanical descriptions are given hereunder:

14 SUMATRA X $1F_1$ —2 FLORIDA-SUMATRA (AX-HYBRID)

Plants very vigorous, varying from 1.7 to 3 meters high; stem from 6.9 to 10.7 centimeters in circumference; total number of leaves from 27 to 42; number of standard leaves from 17 to 30; length of middle internode from 4.5 to 8 centimeters.

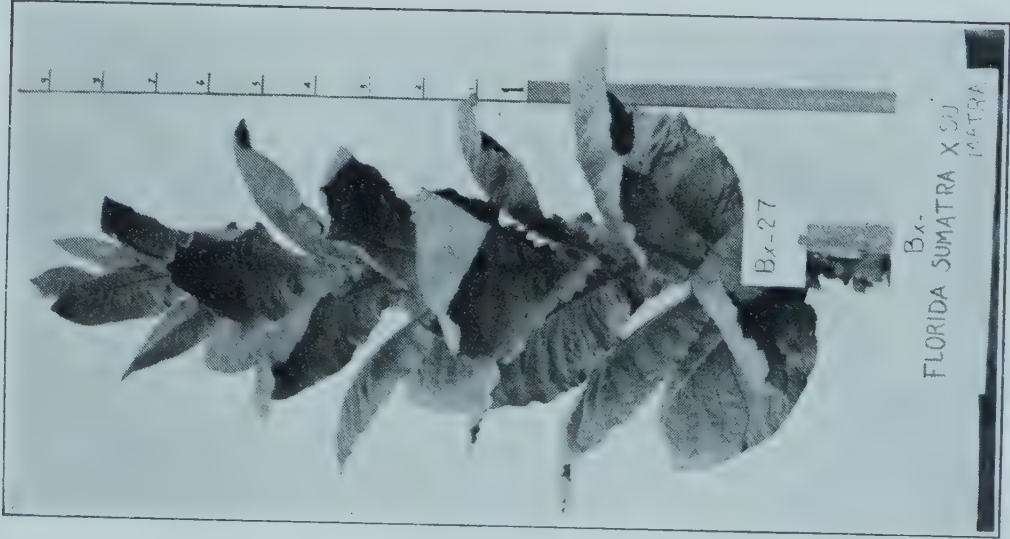
Leaves erect; angle of insertion from 35 to 59 degrees; broad, oval to ovate in shape; surface flat; color between light green and green; pubescent; margin undulate; base auriculate-clasping; petiole broadly winged; apex acuminate to obtuse, slightly drooping; lower standards from 4 to 5.5 decimeters long; 2.5 to 3.5 decimeters wide; ratio of length to breadth $1\frac{1}{4}$ to $1\frac{3}{5}$ times longer than wide.

Inflorescence leaves 45 to 50 degrees as angle of insertion; shape oval; apex acute; margin slightly undulate; surface flat to convex.

Inflorescence open type; flowers in panicles; sparsely arranged; medium in size. Calyx 10 to 12 millimeters in diameter, 18 to 22 millimeters long, gamosepalous, 5 teeth, posterior always longer than the rest; long and acute; shape globular with distinct median construction; midrib of sepals well marked as a distinct dark green ridge. Corolla salver form; appearance not fully expanded; color generally light pink; lobes ovate, edges curved inwards; spread of corolla lobes



(a) Plant of the Ax—hybrid



(b) Plant of the Bx—hybrid

from 18 to 28 millimeters; divisions apical, points small. Anthers 3.5 to 5 millimeters long; 1.5 millimeters thick, pollen abundant; style 4 to 4.5 long; ovary from 6 to 7 millimeters long. Capsule large; 22 millimeters long; shape conical; apex umbilicate.

This cross is a wrapper type, superior in general vigor, height, and size of leaves over any of its parents. It is a distinct improvement over the male or staminate parent, the Florida-Sumatra, as its leaves have finer texture and smaller veins, less gummy, and more resistant to chlorosis, fungus diseases and pests. It suckers less than the male parent.

1F₁—6 FLORIDA-SUMATRA X 14 SUMATRA (BX-HYBRID)

Plants very vigorous, varying from 1.8 to 3.05 meters high; stem from 6.2 to 10 centimeters in circumference; total number of leaves 24 to 42; number of standard leaves from 17 to 30; length of middle internode from 4 to 10 centimeters.

Leaves erect; angle of insertion 30 to 45 degrees; broad, oval to ovate in shape; surface flat; color from light green to green; pubescent; margin undulate; base auriculate-clasping; petiole broadly winged; apex acuminate to obtuse; slightly drooping; lower standards from 4 to 6 decimeters long; 3 to 4 decimeters wide; ratio of length to breadth $1\frac{1}{3}$ to $1\frac{1}{2}$ times longer than wide.

Inflorescence leaves 45 degrees as angle of insertion; shape oval; apex acuminate; margin slightly undulate; surface convex.

Inflorescence open type; flowers in panicles; sparsely arranged; slender in size. Calyx 7 to 10 millimeters in diameter; 15 to 21 millimeters long; gamosephalous, 5 teeth, posterior always longer than the rest; long and acute; shape globular with distinct median constriction; midrib of sepals, well marked as a distinct dark green ridge. Corolla salver forms; appearance not fully expanded; color from very light pink to pink; lobes ovate with undulating appearance; spread of corolla lobes from 20 to 25 millimeters divisions apical, points small. Anthers 3 to 4 millimeters long; 1 to 1.5 millimeters thick; pollen abundant; style 4 to 4.3 centimeters long; ovary 5 to 7 millimeters long. Capsule large 17 to 21 millimeters long; shape conical; apex umbilicate.

This hybrid is a wrapper type, better in more than one respect than the first reciprocal cross, Sumatra X Florida-Sumatra (Ax-hybrid), as the predominating characters are those of the staminate parent, the Sumatra. The plants are slightly more

thrifty and vigorous, greener in appearance, and the present culture contains less pathological forms than the Ax-hybrid. The leaves are larger and broader and have the shape of those of the Sumatra. In wrapper characters this hybrid is very much superior to the pistillate parent, the Florida Sumatra.

2F₁—6 DAMMAO BROADLEAF X 14 SUMATRA (CX-HYBRID)

(Shortened name, "DAMATRA")

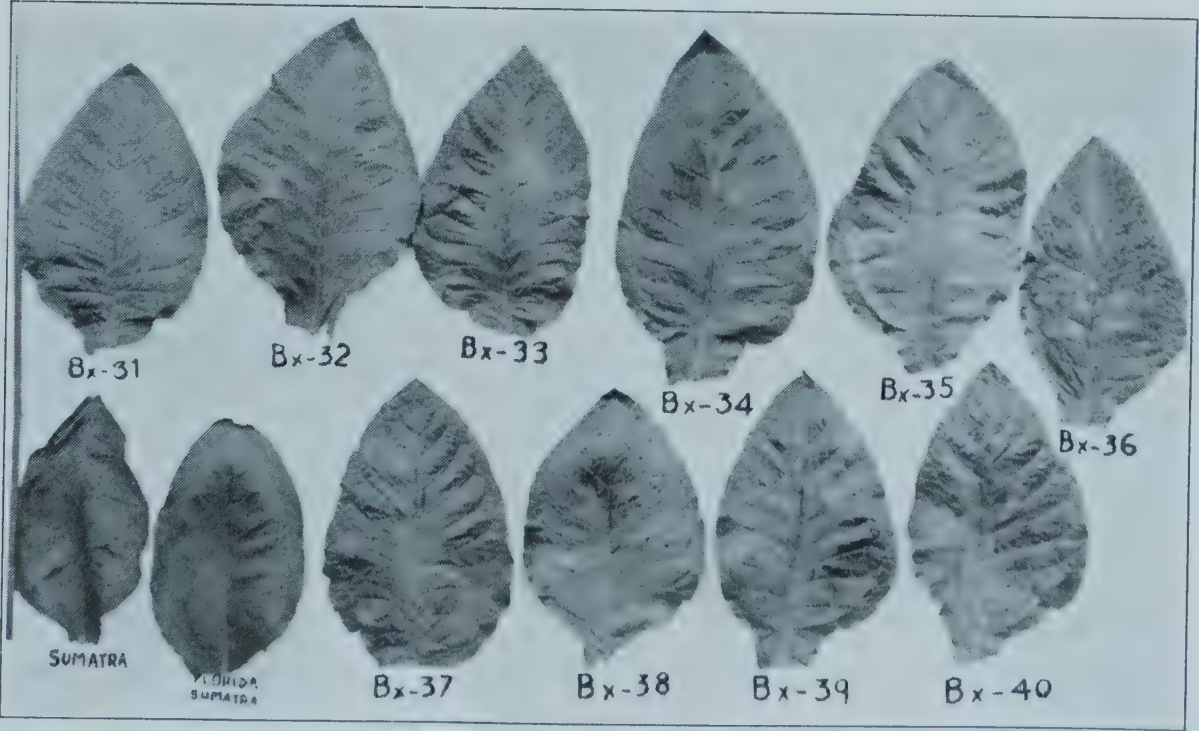
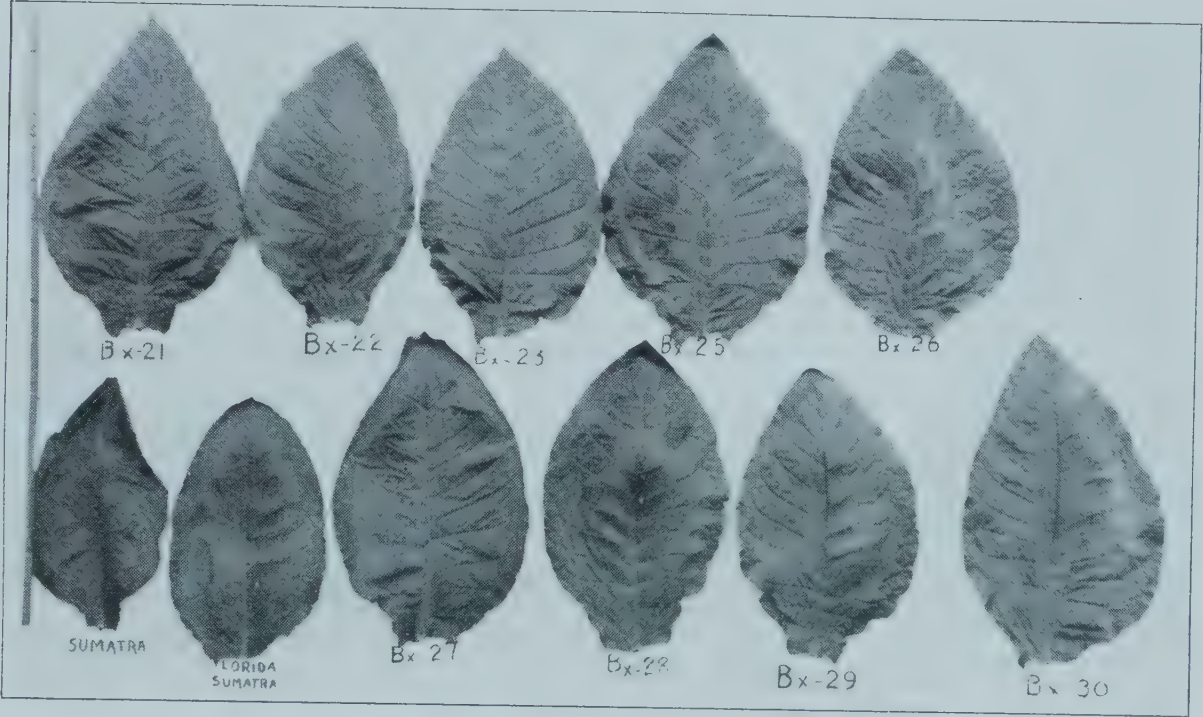
Plants vigorous, varying from 1.6 to 2.9 meters high; stem from 5.7 to 9.4 centimeters in circumference; total number of leaves from 21 to 33; number of standard leaves from 13 to 24; length of middle internode from 6 to 10 centimeters.

Leaves broad, oval to ovate in shape; surface flat to wavy; color green; pubescent; margin undulate to very undulate; base auriculate-clasping; petiole broadly winged; apex acute to acuminate; generally drooping about half from the base; angle of insertion from 45 to 70 degrees; lower standards from 4 to 5.5 decimeters long; 2 to 4 decimeters wide; ratio of length to breadth $1\frac{3}{8}$ to $1\frac{3}{5}$ times longer than wide.

Inflorescence leaves 60 to 70 degrees as angle of insertion; shape oval; apex acute; margin undulate; surface flat.

Inflorescence open type; flowers in panicles; sparsely arranged; slender to medium in size. Calyx 9 to 13 millimeters in diameter; 17 to 20 millimeters long; gamosepalous, 5 teeth, posterior always longer than the rest; long and acute; globular with distinct median constriction; midrib of sepals well marked as distinct dark green ridge. Corolla salver form; appearance generally flat; color pink; lobes ovate; spread of corolla lobes from 25 to 27 millimeters; divisions apical, points small. Anthers 4 to 5 millimeters long; 1.6 millimeters thick; pollen fairly abundant; style 4.3 to 4.5 millimeters long; ovary 7 to 9 millimeters long. Capsule large; 21 to 23 millimeters long; shape conical; apex umbilicate.

This hybrid is a wrapper type, generally with intermediate characters between both parents. Some of the forms retain the characteristic leaf habits of the Dammao Broadleaf, especially in the way the leaves are borne on the stem, being oblique to horizontal, the wavy character of the surface and the very undulating margin; other forms show more the distinguishing characteristics of the Sumatra. The latter are being isolated. The leaves are finer in texture and shorter than those of the pistillate parent. Only half from the base of the leaf is drooping instead of the whole leaf as in the case of the



Shapes of leaves of the different strains of the Florida Sumatra X Baker's Sumatra



(a) Plant-to-the-row test with Florida-Sumatra X Baker's Sumatra (Bx—hybrid)



(b) Plant-to-the-row test with Dammao Broadleaf X Baker's Sumatra ("Damatra")

Dammao Broadleaf. On account of the better arrangement of the leaves, being not so closely overlapping due to the drooping character, the leaves are less susceptible to fungus diseases. There is also a total absence of chlorosis due to the resistant strain of the Dammao Broadleaf used in the cross.

6F₁—2 CONNECTICUT BROADLEAF X 14 SUMATRA (DX-HYBRID)

[Shortened name: "CONMATRA"]

Plants vigorous, varying from 1.6 to 2.3 meters high; stem from 5.6 to 9.1 centimeters in circumference; total number of leaves 19 to 32; number of standard leaves 12 to 22; length of middle internode from 5 to 10 centimeters.

Leaves erect; angle of insertion from 30 to 45 degrees; fairly broad, oblong to oval in shape; surface flat; color green; pubescent; base auriculate, slightly clasping; petiole broadly winged; apex acute to obtuse slightly drooping; lower standards from 4 to 6.4 decimeters long; 2 to 4 decimeters wide; ratio of length to breadth $1\frac{3}{4}$ to 2 times longer than wide.

Inflorescence leaves 65 degrees as angle of insertion; shape lanceolate; apex acute; margin slightly undulate; surface flat to concave.

Inflorescence elongated type; flowers in panicles; slender in size; calyx from 10 to 12 millimeters in diameter; 18 to 22 millimeters long; gamosephalous, 5 teeth, posterior always longer than the rest; long and acute; shape globular with distinct median constriction; midrib of sepals well marked as distinct dark green ridge. Corolla salver form; appearance not fully expanded; color light pink; lobes ovate, edges curved inwards; spread of corolla lobes 18 to 25 millimeters; divisions apical, points small. Anthers 4 to 5 millimeters long; 1 to 1.5 millimeters thick; pollen abundant; style 3.6 to 3.8 centimeters long; ovary 5 to 6 millimeters long. Capsule large, 20 to 22 millimeters long; shape conical; apex umbilicate.

This hybrid is a wrapper type. It seems that it is better adapted to our local conditions of climate and soil than its indifferent female parent, the Connecticut Broadleaf. The characters of the Sumatra, the staminate parent, are dominant over those of the pistillate. There are great improvements in the shape and texture of the leaves.

13 HAVANA X 14 SUMATRA (EX-HYBRID)

[Shortened name: "HAVAMATRA"]

Plants very vigorous, varying from 1.6 to 2.4 meters high; stem from 6.3 to 8.8 centimeters in circumference; total num-

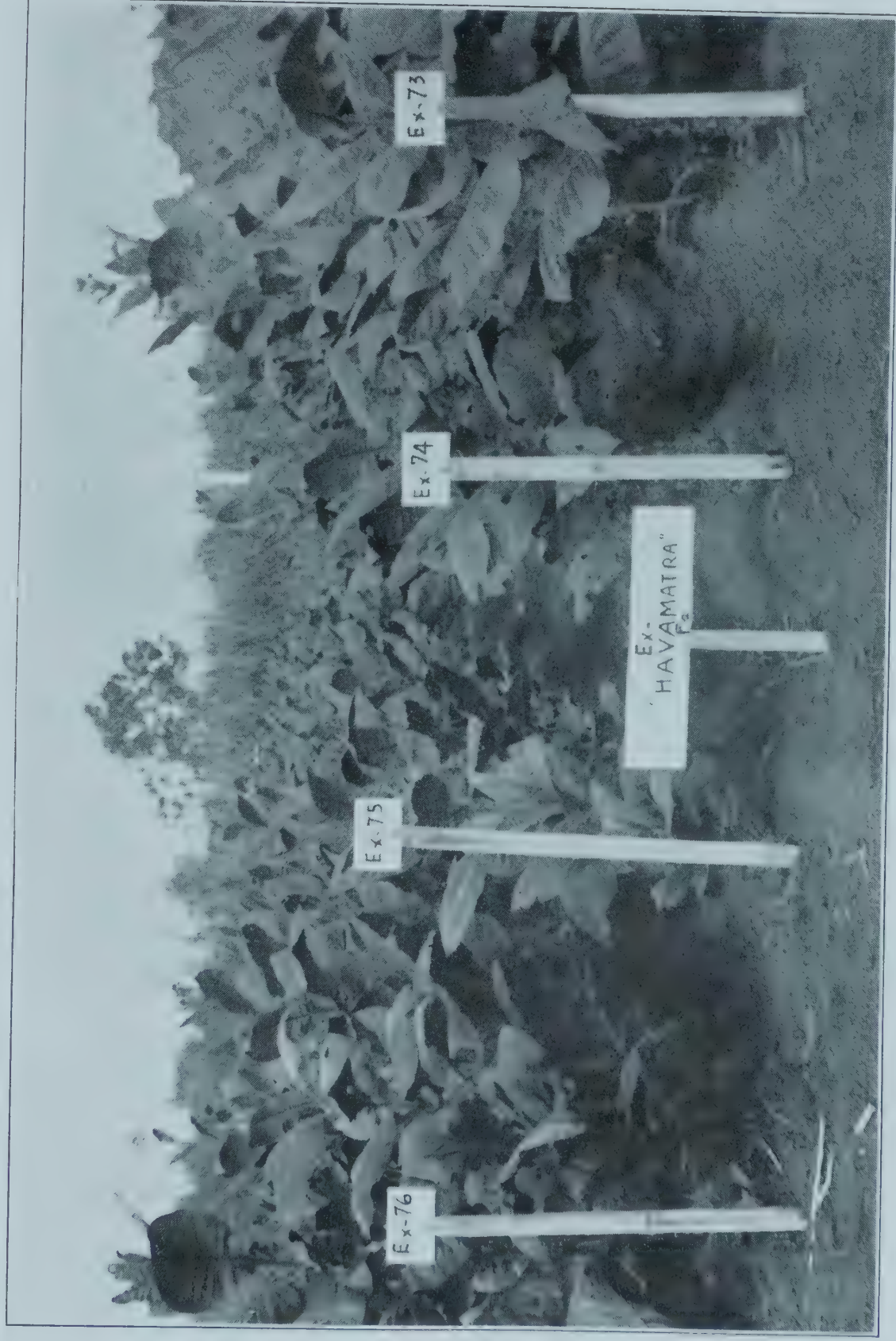
ber of leaves from 21 to 34; number of standard leaves from 14 to 25; length of middle internode from 5.5 to 9.5 centimeters.

Leaves generally erect; angle of insertion 45 degrees; broad, oval to ovate in shape; surface flat; color green; pubescent; margin slightly undulate; base auriculate slightly clasping; petiole broadly winged; apex acuminate to obtuse, slightly drooping; lower standards from 4 to 5.5 decimeters long; 2.5 to 3.5 decimeters wide; ratio of length and breadth $1\frac{4}{11}$ to $1\frac{3}{8}$ times longer than wide.

Inflorescence leaves 45 to 65 degrees as angle of insertion; shape lanceolate to oval; apex acute; margin slightly undulate; surface flat to concave.

Inflorescence elongated type; flowers in panicles sparsely arranged; slender in size. Calyx from 6 to 10 millimeters in diameter; 17 to 19 millimeters long; gamosephalous, 5 teeth, posterior always longer than the rest; long and acute; shape globular with distinct median constriction; midrib of sepals well marked as a distinct dark green ridge. Corolla salver form; appearance not fully expanded; color from very light pink to pink; lobes ovate, edges curved inwards; spread of corolla lobes from 25 to 27 millimeters; divisions apical, points small. Anthers 4 to 4.5 centimeters long; 1 to 1.5 millimeters thick; pollen abundant; style from 3.6 to 4 centimeters long; ovary from 5 to 6 millimeters long. Capsule large, 18 to 20 millimeters long; shape conical; apex umbilicate.

This hybrid is a wrapper type. It surpasses its female parent the Havana in vigor; size and shape of leaves and in texture. The predominating characters are those of the Sumatra. This hybrid seems to give better results in the production of wrapper leaves under local environment conditions than the Havana. Figure 10 shows four rows of this hybrid.



Plant-to-the-row test with Havana X Baker's Sumatra ("Havamatra")

PROGRESS REPORT ON ADLAY¹

By P. J. WESTER

The variety trials with several native kinds of adlay (Plate VII) have been continued at the Lamao Experiment Station.

Mr. H. T. Oberly, commercial manager of the Philippine Engineering Company, Manila; last year called the attention of the Bureau to their "Jrus" mill, as possibly being suitable for hulling and grinding adlay. Since on examination it appeared that the mill would be serviceable for the purpose, arrangements were made to experiment with it after the grain was harvested. These experiments turned out so successful that the entire quantity of adlay flour used for the demonstrations during the Carnival in February in Manila was ground on this mill.

On request, the Philippine Engineering Company later furnished the following estimates for a complete mill:

ESTIMATE NO. 1

- 1 Hopper.
- 1 Single wooden elevator with iron top and bottom case provided with pulley and buckets, 3" wide.
- 1 Jrus Hulling Mill No. 6, diameter of stone 24".
- 1 Single elevator as above.
- 1 Aspirating husk fan with sifter mounted on top to separate the hulls and kernels.
- 1 Jrus Grinding Mill No. 6, diameter of stone 24".
- 1 Aspirating fan with shaking-sieve atop to separate fine and coarse products.
- 1 Complete galvanized iron tubing to interconnect all apparatus as specified above.

The necessary iron frame for mounting the hull aspirating fan above the grinding mill.

Complete shafting with bearings, pulleys, belts, and foundation bolts. Price of machinery as specified above, ₱3,000.

Power required: About 52 H. P.

Capacity: Approximately 80 kilos per hour of baking flour.

ESTIMATE NO. 2

- 1 Jrus Hulling Mill No. 6, diameter of stone 24".
- 1 Single elevator with corresponding pulley and buckets, 3" wide.

¹ For previous articles about adlay, *Coix lacryma-jobi* var. *mayuen*, see this REVIEW, Vol. XIII, p. 217; XIV, pp. 159 and 168; and Vol. XVI, pp. 197, 201, 205, and 212.

- 1 Aspirating husk fan with sifter.
- 1 Jrus Grinding Mill No. 6, diameter 24".
- 1 Aspirating fan with shaking-sieve atop to separate fine and coarse products.
- Galvanized iron tubing to inter-connect all the apparatus as specified above.
- Complete shafting, etc.

Price, delivered f. o. b. Manila, ₱2,500.

Power required: 20 H. P.

Capacity: 70 kilos per hour of baking flour.

Please note that the under frame for mounting the aspirating husk fan has to be made of wood.

In addition to the above specified machinery, it would be necessary to add to each estimate a receiving separator to clean the grain from impurities before it goes to the huller at a cost of ₱180.

Some 70 loaves of graham-adlay bread were baked by the Sanitary Bakery, Manila, the manager of which, Mrs. F. Herier, was so well pleased with the quality of the bread produced that she stated that she would buy adlay flour in quantity whenever it was placed on the market, confident that there would be a good demand for adlay bread.

A large quantity of cakes, biscuits, and muffins were made by the La Perla biscuit manufacturers and Mrs. C. E. Becker, both of Manila, which together with bread were used in the demonstrations. Two demonstrations were made at the Ayuntamiento, Manila, where the adlay products were served at a luncheon and a tea, where many prominent people were present.

Mr. Jose G. Sanvictores, Director of the Bureau of Non-Christian Tribes, furnished the Bureau of Agriculture several sacks of adlay and provided space for the exhibition of the Jrus mill at the Mindanao and Sulu exhibit in the carnival grounds where adlay and adlay literature, bread and other products were distributed.

In this way numerous people made their first acquaintance with adlay as a breadstuff.

The late Mr. Dean C. Worcester, formerly Secretary of the Interior of the Government of the Philippine Islands, and later manager of the Philippine Refining Corporation, after sampling the bread became much interested in the possibilities of the grain and at his invitation a sample of adlay was brought to the oil mill for a milling trial on a Braun pulverizer, manufactured by the Braun Corporation, Los Angeles, California.



Adlay ready for the harvest. Lamao Experiment Station

The hulling on this machine was exceptionally well performed, with fewer broken kernels even than by the Jrus mill, which means less waste in milling.

As a result of the publicity given adlay in this and other publications, requests for seeds have arrived from many countries. Seed was mailed to the Director of Agriculture in Ceylon among others in 1921, and from this the third crop has been harvested. The following account is quoted from the Progress Report of the Manager of the Peradeniya Experiment Station, Ceylon, (*Tropical Agriculturist*, Vol. LXII, No. 5, p. 246, 1924:

“ADLAY, *Coix lacryma-jobi*

A crop of this food grain harvested in December yielded 69 bushels or, 2,484 pounds of grain and 22,060 pounds of straw per acre.

This yield was obtained in plot C 4 of the annual economic area which received an application of the 16 tons cattle manure per acre. * * * Fifteen small lots of grain was distributed to Experiment Station employees including Tamils, Sinhalese, and Mohammedans. Some cooked and ate the grain as rice, some made the flour into a dish known by Singalese as *Pittu* and by Tamils as *Pattu*, and some made it into *Roti*. All expressed their approval of the grain as a food and their willingness to buy it when available. When it is considered that in food value adlay is superior to rice, wheat, or oats, and that yields as quoted above can be obtained the grain appears to deserve considerable attention. A further area has been sown. Six varieties obtained from the Philippine Islands have also been harvested and the seed reserved for varietal tests.

Expressed in terms familiar to readers in the Philippines the yield obtained in Ceylon is at the rate of 2,796 kilos, and 169 bushels, or 80 cavans of grain per hectare.

The following excerpt from a letter recently received from Mr. Philip Jones, superintendent of the San Ramon Penal Farm, Zamboanga, may be of interest:

I find that our corn grinder at San Ramon can be adjusted so that it hulls and grinds the grain very satisfactorily. It will not, however, grind it fine enough for flour. But for a breakfast food, or for a substitute for rice it is sufficient.

I have tried the adlay myself, as a breakfast food, and I like it very much. Also, the prisoners like it very much better than rice.

In a previous letter Mr. Jones says:

The adlay which you gave to Major Barros was planted and is now ready for harvest. It has grown exceedingly well, and the grain seems well matured. It is remarkable how this plant has survived the dry weather. Palay (rice) which was planted at the same time has been entirely burned up by the protracted dry weather we have had ever since last October, yet the adlay does not seem to have suffered a bit.

Of course, adlay will not grow everywhere and under any conditions, but it does so well and is so productive when its requirements are met that its culture should not be given up from a first trial resulting in failure. Unseasonable planting gives a poor yield. Then, we have found that varieties from high elevations do very poorly when planted near sea level and vice versa.

In the course of the milling and baking trials it was found very important that the grain be well dried before it is milled, because if it is incompletely dried, the flour rapidly becomes musty and rancid, the latter no doubt because of the great amount of fat contained in the grain. Indeed, some varieties are so rich in fat that it is possible that they will be found unsuitable for milling into a flour of good keeping quality.

The keeping quality of flour made of Bukidnon adlay was tested this spring, a bag of flour being kept in a pantry beside wheat flour. Except for the infestation of weevils which apparently found the adlay flour very appetizing, and had to be sifted out repeatedly, the flour remained in good condition at the expiration of three months when the experiment was discontinued.

Several months ago the suggestion was made to the writer that commercial gluten might be used in place of wheat flour in making adlay bread, and he then wrote to Dr. C. F. Langworthy, Chief, Office of Home Economics, Bureau of Plant Industry, U. S. Department of Agriculture, Washington, and inquired about the possibilities in this direction. The following reply from Dr. J. H. Shollenberger is both interesting and suggestive to bakers and housewives who may wish to use adlay flour:

UNITED STATES DEPARTMENT OF AGRICULTURE
BUREAU OF AGRICULTURAL ECONOMICS
WASHINGTON

March 1, 1924

DEAR MR. WESTER:

Your letter of December 27, 1923, to Dr. C. F. Langworthy, regarding the addition of gluten from wheat flour to adlay flour has been referred to this office for reply.

I cannot state as to the practicability of the idea as this office has not carried on any experiments of this kind. However, Bulletin No. 139, entitled "Some Factors Related to the Quality of Wheat and Strength of Flour," of the North Dakota Experiment Station, Agricultural College,



A plate of adlay biscuits, made of equal parts of whole-adlay and wheat flour

North Dakota, contains results from adding gluten to wheat flour in addition to the normal amount present. The results of these experiments are given below:

TABLE I.—*Showing the influence of added Gluten on strength of wheat flour*

Samplpe	Protein content	Loaf volume	Color of crumb	Texture of crumb
Check sample.....	12.37	2,670	95	96
Check plus gluten.....	15.00	2,790	95	96
Check plus gluten.....	40.00	3,240	85	94
Check plus gluten.....	100.00	17,000	.....	.....

¹ Calculated from a smaller quantity

The author of this bulletin says, "It is interesting to note in studying the influence of the quantity of protein on strength what happens upon increasing the percentage much higher by the addition of extra gluten. The volume produced by an amount of gluten (dry basis) equal to the quantity of flour used per loaf in the regular baking tests (340 grams normal moisture basis) provided so large a quantity would respond relatively the same as a smaller quantity, would be 7,000 cubic centimeters."

This author also states,—“The relative efficiency of protein in the softer wheat is not as great as the same percentage in bread wheats.”

In so far as I have been able to find out, gluten flour which is sold on the market there in Washington for the purpose of making gluten bread (the gluten flour guaranteed to contain 40 per cent gluten) sells at the place of manufacture for \$40 per barrel (196 pounds). A baker in this city tells me that with a higher percentage of gluten than this it would be almost impossible to make a commercial loaf of gluten bread that would be acceptable to the users of such bread.

As you probably know, it is more the quality of gluten in wheat flour than the quantity that gives the flour its baking strength. Although I am not familiar with the gluten product sold on the market, it occurs to me that it would not possess the necessary quality even when mixed with wheat flour that it had before it was washed from the flour due to its different physical properties. Therefore, it occurs to me that if any blending of this substance with adlay is to be practiced it would be cheaper and more satisfactory from a bread making standpoint to mix some of the high quality hard wheat flours with whatever percentages of adlay that may be found desirable.

The commercial grade of flour known as “low grade” is sometimes erroneously called gluten flour because it contains a few per cent more of protein than the “patent,” “clear,” and “straight” grades milled from the same wheat. The quality of the gluten in this “low grade” flour, however, is inferior to that in the other grades. This grade of flour can be purchased at prices much lower than the patent grades, but because of its low quality, I do not believe it would be satisfactory for your purpose.

Very truly yours,

J. H. SHOLLENBERGER
Milling Investigations

Major problems in connection with adlay which still remain to be worked out relate to:

1. The vitamine content and the digestibility of the grain of the different sorts.

In this connection it is interesting to recall that food prepared from adlay has been recommended for invalids, and that in Tonkin, adlay is spoken of as the "grass of life and health," and that there is very considerable variation in the analysis of the grain in the different forms of adlay. See this REVIEW, Vol. XIII, p. 221, and Vol. XIV, pp. 161 and 165.

2. The practicability of using the grain for the manufacture of biscuits and hardtack, and for beer.

The late Dean C. Worcester stated that beer made of adlay by the Bukidnons was of very good quality, while in *Commercial Products of India*, Watt says about adlay beer: "I have personally experienced much pleasure while traveling in the Naga hills in partaking of the fresh *dzu* offered in friendly salutation. It is something in flavor between that of buttermilk and cider, and on a hot day at the termination of a long march is most acceptable. Some of the forms of *coix* (adlay)—are said to give the beer a fruity flavor and aroma."

3. The possible utilization of the straw for the manufacture of paper.

If the dried straw would be found to make good paper material this would naturally increase the revenues of the planter of the grain.

THE PAST AND PRESENT WORK OF LA CARLOTA EXPERIMENT STATION

By SILVESTRE ASUNCION

*Superintendent and in charge of Sugar Cane Investigation
La Carlota Experiment Station*

INTRODUCTION

The La Carlota Experiment Station was established during the Spanish regime and it was known as La Granja Modelo. The station was established to meet the demand of the planters in Negros. As Negros became a sugar district, the station began also to plant sugar cane, and a muscovado plant was put up to grind the cane. At that time the work of the station was run by *aparcería*. During the revolution, in 1896, the work of the station was paralyzed and the work was not resumed till after the year 1909.

Mr. H. J. Gallagher of the Bureau of Agriculture took possession of the place as superintendent of the station. He planted sugar cane and ran the muscovado plant. During his time part of the station was converted into pasture for the newly imported animals from India. This was done in order to meet the demand of the planters for better grade of work animals because at the time rinderpest was so prevalent that many of the work animals died in Negros. The imported animals from India are to some extent immune to the disease.

Later this work on the production of muscovado was abandoned and the muscovado plant was disposed of. From that time up to 1922 the activity of the station was confined to growing different crops; such as, corn, rice, abaca, maguey, fruit trees, and including, of course, the cultural experiments of sugar cane, etc. The experiments on the different projects besides sugar cane were carried out at La Carlota, because of lack of place in the other stations of the Bureau. The Bureau of Agriculture later on, however, was able to confine its activity to sugar cane and animals. As the records obtainable are from 1915 only, the following projects are described:

UPLAND RICE PROJECT

The upland rice project of the La Carlota Experiment Station has been conducted since 1915 with general seed selection and

miscellaneous cultural experiments. From this time up to 1922 the number of experimental jobs increased to 7 in number. The following were the experimental jobs:

1. Seed longevity tests.
2. Acclimatization tests.
3. Head-to-the-row tests.
4. General seed selection.
5. Variety tests.
6. Drill method *vs.* Native method of planting.
7. Irrigation experiment.

Seed longevity tests.—The object was to determine how long seed palay could be kept without injuring its vitality by placing it in available containers. Seed palay of different varieties has been placed in seed cans with wood ash sprinkled over the seed; placed on top of and in sacks and basket with wood ash over the seed; a regular sized bundle of seed palay in heads was also left hanging uncovered near the above containers.

From the two tests made it was found that the basket as container for seed palay is the best among the containers used.

A test was made by placing the seed palay in sacks without any ash and it was found to lose their vitality in one year's time.

Acclimatization tests.—The object in view was to acclimatize the high yielding varieties both native and foreign, for distribution among the rice growers in Negros.

These tests were started in 1918 and stopped in 1920.

The foreign varieties were mostly from Japan, China, Saigon, Siam, and the United States; while the native varieties came from different provinces of the Philippine Islands.

The Results from three years' testing have shown that most of the foreign varieties do not thrive well and do not show their high yielding quality in this place, with the exception of a few which give higher yields than many of the native varieties. The foreign varieties found to be acclimatized in this place and to give good yield are 1188 Sekitori, 1290 Blue Rose I, and 1266 Early Prolific.

Native varieties are found to be admixtures, that is, in variety there exist at least two different kinds of grains with red and white cuticles. Some are found also to be poor yielders.

Head-to-the-row tests.—The object was to isolate the best strains within a high yielding variety. After isolation the best strains were multiplied and distributed to the rice growers in Negros.

Every good selected head from the selected plants was planted to the row. This had been done for two years only, due to lack of funds. Five high yielding varieties were used. From these, several high yielding strains in each variety were isolated and transferred to Lamao Experiment Station. The experiment is being continued there.

General seed selection.—The object is the isolation of the best yielding plants which are also resistant to diseases and pests.

The seeds of these were used for every next planting season.

The result shows that yields increased and better stand of plants than before was secured.

Variety tests.—The object is the isolation of the high yielding varieties.

This experiment was started since 1916 with 49 varieties. The number of varieties increased gradually to 166 in number. The varieties were from the different places in the Islands and from Japan, China, Saigon, and United States.

From the six years tests of this experiment there have been found 27 varieties that are very good yielders. Their yields range from 41.3 to 61.3 cavans per hectare. The rest are found to be poor yielders.

Most of these varieties have been distributed to rice growers nearby.

Drill method vs. Hill method of planting upland rice.—The object is to determine the cheapest method of growing upland rice with good returns.

This experiment was conducted in 1922 with two varieties; namely, Mayoro II and Tuhao or Caot.

In the drill method of planting seeds were planted in drills in the rows of 50 centimeters apart to allow animal cultivation.

In the hill method seeds were planted 30 x 30 centimeters apart. The average number of plants per hill was 12. Every expense incurred in each experiment was noted separately. Cultural treatments needed by each were given.

The drill method of planting upland rice was found to be more economical and more crop was obtained from the same given area than the hill method.

Irrigation experiment.—The object was to determine whether upland rice could be grown successfully under lowland conditions or not.

The test was made in 1916 with Inantipolo and Calibug upland varieties with Minatanda lowland variety.

From this test the upland varieties used did not produce good yields. There are, however, some upland varieties that can be grown under both upland and lowland conditions, like Lubang Blanco and Lubang Pula.

CORN PROJECT

The corn project was started at this station since 1914 with three experimental jobs and increased to five in number. The following are the experimental jobs:

1. Seed longevity tests.
2. Acclimatization tests.
3. Ear-to-the-row tests.
4. General Seed selection.
5. Variety tests.

Seed longevity tests.—The object of this test is to determine how long it takes the seed corn to lose its vitality by storing it in available containers.

This experiment was started since January, 1922.

Six varieties viz. Baluga yellow, Cagayan yellow, Calamba, yellow, Bohol white, Cebu white, and Moro white were used. Monthly germination tests were made in shelled and unshelled materials.

From one test it has been found that it is better to store the seed corn in ears than in shelled form. Seed corn could be stored ten months after harvest in ears in seed cans.

Acclimatization test.—This test has been started since 1916 with varieties from different provinces of the Islands.

The seeds of each variety were planted separately so as to avoid cross pollination between different varieties.

From four tests there have been found varieties, namely, Baluga yellow, Cagayan yellow, Calamba yellow, Bohol white, Cebu white, and Moro white well adapted to this place. These varieties have been distributed to corn growers in Negros and elsewhere.

Ear-to-the-row tests.—The object in view is to isolate the high yielding strains within a high yielding variety.

Results from 1920 with Cebu white and Cagayan yellow show that the strains isolated produced higher yield than those unshelled strains. The strains isolated are being planted at Lamao Experiment Station, Lamao, Bataan.

General seed selection.—The object is to select only pure seeds from the best plants in the field for next planting season.

This work was started since 1914. Most seed corns are admixtures of red and white kernels. This is due to the impurity of the seed used for planting and the presence of cross pollination of the different varieties of corn.

As a result of this work we obtained good yielding and pure seed corn of different varieties. These are being used for study of the characters, etc., and for multiplication and distribution to the corn growers in Negros and elsewhere.

Variety test.—The object is to determine which corn varieties are high yielders and which are low yielders.

This experiment was started since 1915. Six varieties were used. Each variety was kept pure as possible.

From the five tests made it has been found that Beluga yellow and Cagayan yellow are the highest yielders and that the Bohol white is the lowest yielder.

Calamba yellow, Cebu white, and Moro white are found also high yielders and are also recommended for planting to corn growers in Negros besides Baluga yellow and Cagayan yellow.

COFFEE PROJECT

The object was to test whether coffee plants will grow in this place.

Different varieties of coffee plants were planted at this station since 1916 at a distance of from 2.7 x 2.7 meters to 4 x 4 meters apart.

Most varieties in 1916 were found growing successfully and producing plenty of berries.

Robusta, Uganda, Canephora, Abeocuta, and Excelsa are the example.

Plenty of seeds have been distributed from these plants.

ROOT CROPS PROJECT

During the food campaign miscellaneous root crops have been introduced into this place to test their adaptability and determine their yields.

The following root crops are found to grow well in this place:

1. Sweet Potato (Different varieties).
2. Cassava, *Manihot*, *Utilisima* Pohl. (8 varieties).
3. Tugui (10 varieties).
4. Ubi (6 varieties).

As they grow successfully variety tests have been conducted on each crop.

The results of our variety tests are as follows:

1. Mallon P. I. 7344 gave the highest yield per hectare of 28,500 kilos, Linoco P. I. 7341 ranked second yielding 27,333.33 kilos from one test of sweet potato.

2. Kapo white or green variety gave the highest yield being 26,300 kilos per hectare among the eight varieties tested in three tests. Many cuttings were distributed to some hacenderos in Negros and elsewhere.

3. From 1917 to 1922 results on our Tugui variety test, it has been found that Batangas I produces the highest yield among the 10 varieties used.

4. From 1921 to 1922 results on our Ubi variety test, Minan-ug gave the highest yield of 49,500 kilos per hectare. Second was Quinalabao.

VEGETABLES

During the food campaign several kinds of vegetables have been tested at this station as shown in our records, the following are found to grow well at this place:

- | | |
|------------------------------------|---------------------------------|
| 1. Ampalaya. | 27. Squash, long native. |
| 2. Asparagus. | 28. Squash, round white. |
| 3. Cabbage, Chinese. | 29. Upo. |
| 4. Cabbage, Henderson Summer. | 30. Cucumber, prolific sort. . |
| 5. Cabbage, Copenhagen market. | 31. Cucumber, Indian Nepeul. |
| 6. Dill. | 32. Cucumber, green variety. |
| 7. Endive. | 33. Cucumber, Rungpur. |
| 8. Lettuce, Big Boston. | 34. Cucumber, Telegraph. |
| 9. Lettuce, May King. | 35. Eggplant, Long Purple. |
| 10. Musk melon. | 36. Eggplant, short. |
| 11. Okra. | 37. Eggplant, white. |
| 12. Patola, Castila. | 38. Atabo, black. |
| 13. Patola, Tagalog. | 39. Batao, white. |
| 14. Patola, Binalingbing. | 40. Bean, Early June. |
| 15. Pepper, Bell. | 41. <i>Centorsema Plumore</i> . |
| 16. Pepper, <i>Anahuin</i> . | 42. Kibal, white. |
| 17. Pechay. | 43. Large hybrid. |
| 18. Pechay <i>proper</i> . | 44. Lamao white. |
| 19. Radish. | 45. <i>Liar bean</i> . |
| 20. Radish, Daikon Mikado. | 46. New era cowpea. |
| 21. Radish, Japanese. | 47. Patani. |
| 22. Radish, Sakuna, jornameammoth. | 48. Pole bean, large. |
| 23. Rape. | 49. Seguidillas. |
| 24. Roselle, <i>Anchor</i> . | 50. Tahore. |
| 25. Roselle, Rico. | 51. Utang. |
| 26. Squash, Boston. | |

FORAGE CROP PROJECT

This project has been started since 1914 to meet the demand for forage.

Several grasses, such as *Alfalfa grass*, Bungalon grass, Guinea grass, Para grass, Natal grass, Napier grass, Spineless cacti, Uba or Japanese cane, Rhodes grass, Sudan grass, Beggar weed, and Carpet grass have been introduced here. Out of these forage crops, the following are found to be adapted to this station and are good for animals:

1. Guinea grass is the best forage crop. It can be grown easily and monthly cuttings can be gathered. It is succulent and relished by animals. It is best for an hacendero to have at least a hectare of this forage for his work animals.

2. Bungalong grass is good only under lowland condition for carabaos.

3. Para grass is next to Guinea grass. It is very easy to grow. Just plant the cuttings and after the plants have covered the ground no cultivation is needed. It is succulent and is readily eaten by animals.

4. Japanese cane needs good care but gives good returns. When the plants are young they are very good for animals. If plants are cut from the base they shoot readily.

5. The Sudan grass was found to be also useful as a forage crop at this station but at present there is none under cultivation at this station.

ABACA PROJECT

This project was started since 1915 with the object in view of finding what varieties are suited to this place and give high per cent of fiber.

The following experiments then have been conducted with good results:

1. Variety tests.
2. Suckers vs. Seedling tests.

Variety tests.—The object is to determine the per cent of fiber from the stalks of different varieties of abaca.

Ten varieties from Mindanao, eleven from Leyte, five from Negros, and nine from Southern Luzon were used. Only ten hills of each variety were selected for the test. The stalks were harvested after the flower bud has appeared and were weighed. The fiber obtained from each stalk was kept separate from each

other, then dried and weighed to determine the per cent of dry clean fiber from the weight of the stalk.

From the results obtained it has been found that among the 35 varieties of abaca the following are the best yielders:

	Per cent of fiber
Mindanao varieties:	
1. Tangongon	2.106
2. Bangalanon	2.103
3. Sinab-á	1.737
Leyte varieties:	
1. Mininonga	1.728
2. Libutanay	1.604
3. Laguis	1.531
Negros varieties:	
1. Lono	1.082
2. Moro	1.058
3. Bisaya	1.022
Southern Luzon varieties:	
1. Sugmod	1.376
2. Bulao	1.374
3. Canorahan	1.369

From the above it can be seen that the Mindanao varieties gave the highest per cent of fiber, the Leyte second, the Southern Luzon third, and the Negros the lowest.

In connection with this variety test flowering age was also observed to determine how long it takes for each variety to mature.

It has been found that some varieties are late and some are early.

The following are the results:

Section	Early varieties	Late varieties
Mindanao	Libuton, 787 days	Tangongon, 1,219 days.
Leyte	Lagurhuan Dogami, 686 days .	Laguis, 1,535 days.
Negros	Kalao, 515 days	Moro, 937 days.
Southern Luzon	Ilayas, 565 days.	Bulao, 1,047 days.

Suckers vs. Seeds.—The object is to determine which is better to plant suckers or seeds.

From the 12 varieties tested, it has been found that those plants grown from seeds have very variable fiber contents. Some stalks were found to yield no fiber at all. Some, however, have very high fiber content. Due to this variability in the per cent of fiber of plants grown from seeds, those plants grown from suckers gave higher per cent of fiber per stalk on the average than those grown from seeds.

It has been observed that suckers of these plants planted from seeds are less susceptible to heart rot disease of abaca than those suckers of the plants grown from suckers.

MAGUEY AND SISAL PROJECT

This project according to records was started since 1916.

The following experiments have been conducted at this station with good results:

1. Suckers *vs.* Bulbils.
2. Method of fiber extraction.

Suckers vs. Bulbils.—The object is to find out which one gives better yield of fiber.

Mature leaves of maguey and sisal grown from suckers and bulbils, were used and then each leaf was split into 4 or 5 parts. The pieces of leaves were bundled and immersed in fresh running water.

The data show that the percentages of fiber from plants grown from suckers were higher than those grown from bulbils. It was also observed that the leaves of plants grown from suckers were larger than those grown from bulbils.

Method of fiber extraction.—The object was to find the best method of extracting fiber from maguey and sisal leaves.

The methods used are:

1. Entire leaf *vs.* Split leaf.
2. Salt water *vs.* Fresh water and knife stripping.

Entire leaf vs. Split leaf.—The object is to determine which method is the easiest and gives the highest per cent of fiber.

The maguey and sisal leaves were divided as follows: First group—entire leaves of each kind were bundled and retted; second group—maguey and sisal leaves split into halves each; third group—maguey and sisal leaves split into 4 parts; fourth group—maguey and sisal leaves split into 6 parts; and fifth group—maguey and sisal leaves split into 8 parts.

It has been found that the more the leaves are split into small pieces the shorter it took for them to ret in water or until the fiber was ready for extraction. And in one test it has also been found that the smaller the leaves were split the higher the percentage of fiber was obtained.

Salt water vs. Fresh water and knife method.—The object was to find which is the best method of retting maguey and sisal leaves in order to obtain the highest percentage of fiber.

The following methods were used for extracting the fiber:

1. Knife stripping process similar to the native method for extracting abaca.
2. Salt-water retting process.
3. Fresh-water retting process.

Under the first process the fiber was washed in water after stripping and then dried to remove the greenish color remaining on the fiber.

From the data obtained, the salt-water retting process gave the highest percentage of fiber, the fresh-water ranked second and the knife-stripping process, the third.

MISCELLANEOUS HORTICULTURAL PROJECT

The object was to determine whether fruit trees would thrive well at this station.

Our records show that this project was started since 1915. Many fruit trees have been introduced here from the different countries.

Among those introduced, ates, atemoya, avocado, carambola, babana, camansi, guava, lemasa, phalsa, and sefalus have been found to thrive best here.

SUGAR-CANE PROJECT

The only record available for this project dates back since 1916. There were several experiments; hybridization, stool-to-the-row test, bud selection, fertilizer test, distance of planting, miscellaneous cultural treatment, and miscellaneous experiments.

Hybridization was begun in 1921. The object in view of this experiment was to obtain a variety or varieties that may suit the planters in the production of sucrose and fiber content. Under this experiment two methods were employed; artificial (emasculation of the cane flowers) and natural hybridization (panicles of the varieties to be crossed are placed in a bag in such a position that the pollen of the arrow of the male variety was shed to the flowers of the female variety).

Though no results were obtained as yet in this work, it is expected that in the future this will give a great benefit to the cane planters.

The production of seedling varieties from the promising canes, is going to be carried out as this is more practical than artificial and natural hybridization. This practice promises to give excellent results in the matter of creating superior varieties. Some

of our seedlings show new strains which are quite different from the mother plants.

Bud variation.—This experiment has to be put under the experiment under stool-to-the-row test as they practically aim the same point of view. However, bud mutation has to be observed. For instance in the case of Big Tanna, 3,525, there appears a spot of white variety which is similar to Yellow Caledonia. This is confined to nursery and considered a new variety. This kind of experiment takes several years before satisfactory results are obtained.

General seed selection.—Under this experiment the points are selected and the small ones and those infected with diseases are discarded. A good result was obtained. If the present mosaic disease in some districts in Negros is not controlled, it is likely that the planters in that locality will look for these selected seeds or points in the station not very long.

Variety test.—This experiment has benefited already many farmers in Negros. Only those varieties which are very promising are recommended to the planters giving them information as to the yield of sucrose and fiber content. Badila, Goru, H-109 and Barbados are the most looked for by the planters. The distribution of these tested varieties are of great help to the farmers especially in those district where the cane has degenerated and been badly affected by diseases in which case the local variety has to be changed.

Fertilizer test.—This experiment is very important for the farmers to know. The object is to find which kind of food elements are needed by the plants. This experiment ought to be done in different places in Negros as different districts may need different kinds of fertilizers. As our resources are very limited, our work in this line is confined to this station alone. Our results here may be used as a guide by the planters. It is but lately that the use of commercial fertilizers is generalized. The "Big Crop" fertilizer of the Sugar Central Agency has become very popular that almost every planter in Negros asks for it. The "Big Crop" is a mixed fertilizer containing 9.51 per cent nitrogen, 4.95 per cent phosphoric acid and 3.76 per cent potash. This fertilizer is good only for general purposes and not for specific cases. In many places only nitrogen is needed in which case the application of phosphoric acid and potash is only wasted. The use and application of fertilizers

to the worn out and poor soil can best be studied by the farmers themselves in their own fields and a big economy in time and money can be introduced into his own hacienda.

CONCLUSION

In conclusion it may be considered that the main work of the station at present is confined to sugar-cane experimentation and to raising of live stock. This is done in order to meet the demand of the Negros planters in particular. Since the adoption of the new policy of the Bureau, eight hectares of land were planted with cane in 1922. On December 1922, all the fields were planted. The cane is found in excellent condition and the estimated average yield is about forty tons to the hectare.

Planters who visit the station and see our cane leave nothing but praise to our promising varieties. They request especially Badila points.

Live stock in the station is the attraction of the public. The purpose in keeping and in raising the Indian breed of cattle is to help the farmers in possessing this strongly resistant animals to rinderpest. Day by day the farmers buy young calves for breeding purposes. The pure bred is crossed with the native cows. The result is mestizo. The half-breed served very well as work bullocks. The station is keeping 20 work bullocks. The superiority of this mestizo over the native is questioned by the farmers. Recently, however, Mr. Marciano Araneta of Bago, Occidental Negros, who obtained authority to buy 10 mestizo work bullocks from the station was so pleased with the services rendered to his farm by these animals that he wants to get all the mestizo work bullocks he can buy from the station. The station can meet the demand of the planters in Negros by keeping these two projects alone; sugar cane and animals.

THE TANAUAN CITRUS STATION AND ITS WORK

By JOSE DE LEON

Superintendent, Tanauan Citrus Station

In the opinion of the citrus fruit growers of Tanauan and Santo Tomas, Batangas Province, the eruption of the Taal Volcano in 1911 brought about the decline in the fruitfulness of their mandarin orange groves. It is claimed that the lava from the volcano was deleterious to the trees, and that, where it fell thickly, it caused fatal results to them. Moreover, it is also believed that the continual emission of smoke from the volcano previous to the eruption had favorably influenced the fruiting of the trees, and when this supply of smoke disappeared, after the eruption had taken place, the fruiting of the trees had consequently suffered.

Just how much truth there is in these assertions is quite difficult to tell, because, shortly after that event came a drought which undoubtedly, caused much, though unsuspected injury to the groves. Moreover, the general dissatisfaction among the growers soon after the eruption, has brought other causes of injury to the groves; such as, neglect, and the increase in the number of diseases and pests. It is generally admitted, however, that the degeneration of the mandarin groves of Tanauan and Santo Tomas began just after the year of the eruption.

The seriousness of the situation was soon realized that in 1912 and 1913, investigations of conditions in the citrus district were made by the Bureau of Agriculture. In an attempt to improve the devitalized groves, an agent was temporarily detailed to help the growers. Pruning and tree surgery were the means employed to save the trees. The value of this work has been appreciated by the growers, although, unfortunately, not enough to revive their former faith and interest in the mandarin orange industry.

The Government has not lost sight of the difficulties encountered by the growers of Batangas, who are the principal producers of citrus fruits in the Philippines. In 1919, it has established the Tanauan Citrus Station, solely for the study of the citrus situation with the object of finding remedies for its improvement. It was for this purpose that a typical rundown

and neglected grove was selected as a suitable material for the work. However, much of the work as it is undertaken, at present, is of general interest to citrus growing in the Philippines.

The Tanauan Citrus Station is located on the provincial road, two kilometers south of the town of Tanauan, Batangas. The soil of the station is a clay loam underlain by an adobe subsoil. Although this soil is considered inferior to the deep, light loamy soils of the coastal region of Lake Taal, it nevertheless represents the average soil conditions of a greater portion of the citrus district in Batangas.

The activities of the station include the testing of introduced varieties as well as selected local forms of the important citrus fruits; studies on the cultural and fertilizer needs of the mandarin orange; practical demonstration of the value of top-working in the rejuvenation of mandarin orange trees; studies of the methods of combating diseases and insect pests of citrus; and the propagation of citrus plants for distribution to the public.

In an effort to find out which varieties of citrus do best under Batangas conditions, the station has planted a collection of the most important varieties available. At present, 93 introduced varieties and 30 local selections of commercial citrus are being grown in the station. A few of these varieties are also being grown under the coöperative trial plan, in different parts of the province. These varieties are being tested with regard to their adaptability to the soil and climate, quality of fruit, bearing habits, and resistance to diseases and insect pests. It is hoped that the outcome of this work will be of value not only to this province, but also to others having a similar type of climate.

The studies on the cultural and fertilizer requirements of the mandarin are carried on in the station's grove, which contains some six hundred trees twenty years old. Here the most approved methods of tree pruning are practised, suitable cultural treatments of the grove sought and the value of the different fertilizers tested, in an effort to restore a degenerated grove to its former state of productiveness.

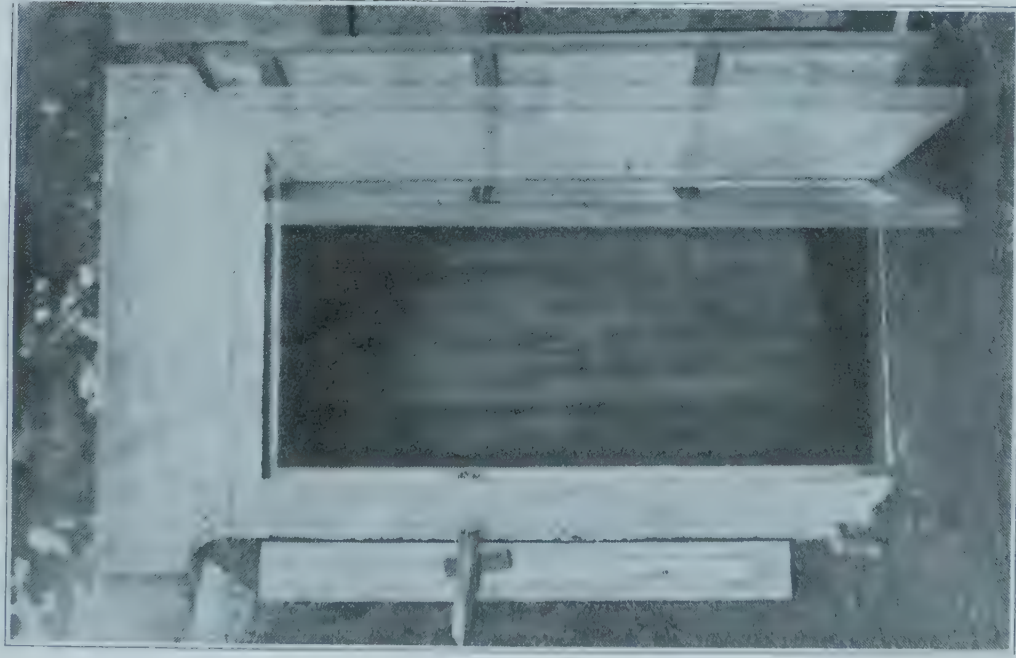
In connection with the rejuvenation work, top-working has been practised. Upwards of fifty citrus varieties are grown to determine their value for renovating the tops of old, unproductive mandarin trees. The results of our first attempts in this work have demonstrated the feasibility of transforming unproductive and weak mandarin trees into vigorous and productive trees by the use of scions that do well on this stock.



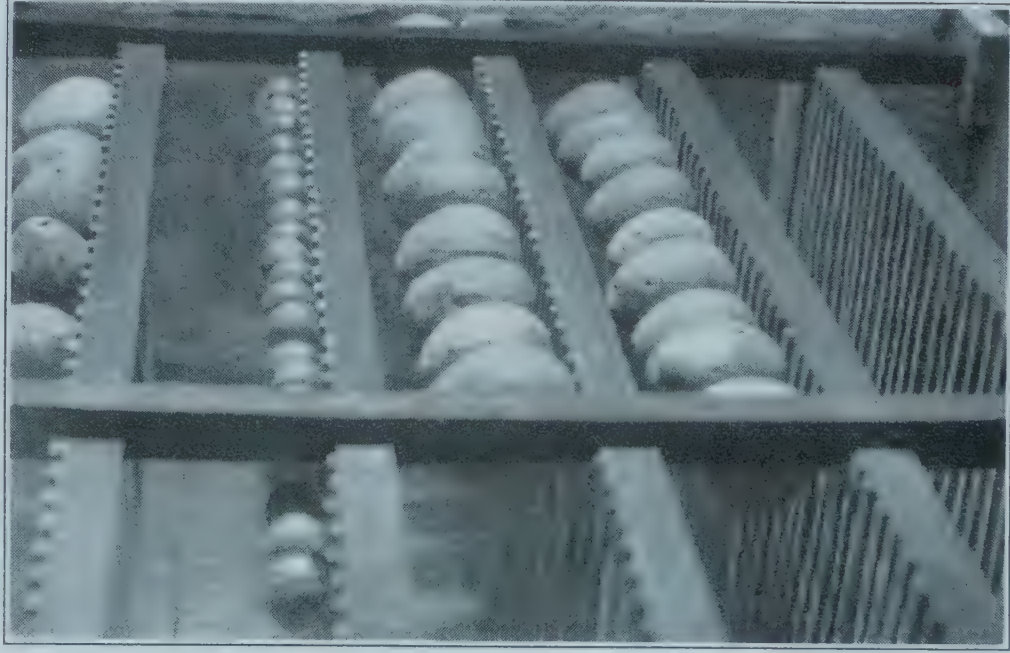
(a) A view of a portion of the Citrus Orchard. Tanauan, Batangas



(b) Citrus Nursery, Tanauan, Batangas



(a) Exterior view of the storage chamber



(b) View of the interior part of the chamber

The station has been conducting experiments on the storage and curing of citrus fruits. The object of this work is to find a practicable means of preserving the fruits to lengthen the period of time in which they may be marketed. Some interesting results have already been obtained from the use of an underground, ventilated storage chamber. It was found that it is practicable to keep mandarin oranges in this chamber at least six weeks, and to the improvement of their appearance and eating quality. This work is being continued in order to determine the best material for constructing the chamber, and also to find out the best disinfectant for washing the fruit.

The disease particularly responsible for the degeneration of the mandarin groves of Batangas is bark rot. The station has instituted preventive as well as curative measures for the control of this disease in its grove. These measures include the pruning off of diseased twigs and branches, white-washing of trunks with concentrated Bordeaux mixture, local applications, on the diseased areas, of disinfectants, after a partial or a complete elimination of the affected tissues. Observations are also made on the effects of different systems of culture and fertilization, with regard to the appearance of the disease.

Since the establishment of the station, a citrus nursery has been in operation to produce budded plants for distribution by the Bureau of Agriculture, and there is a steadily increasing demand for these plants of the exotic as well as the local varieties of citrus the station has.

A DESCRIPTIVE LIST OF MANGO VARIETIES IN INDIA: AN ADDENDA

By P. J. WESTER

A Descriptive List of Mango Varieties in India, first published in this *Review*, Vol. XIII, and later issued by this Bureau as Bulletin No. 36, was believed at the time of its publication to be a fairly comprehensive compilation, including 281 varieties. However, it was only just off the press when I received from the senior author a bulletin entitled *The Book of the Mango*, by Dr. W. Burns, economic botanist to the government of Bombay, and Mr. S. M. Prayag, of the Department of Agriculture, Bombay, India, containing descriptions and line drawings of 88 varieties, most of which were not included in my list. A little later, Mr. S. Percy-Lancaster, Secretary of the Agricultural and Horticultural Society of India, Calcutta, who had received my list, kindly forwarded to me the *Proceedings and Journal* of the Society from 1916 to 1921 which contained a descriptive list of 366 mango varieties—a very large part of which were also unknown to me—prepared by Mr. Percy-Lancaster, who also wrote me commenting on the varieties included in my own list. As correcting certain errors that had crept into the list compiled by me, and also because of the additional information contained therein, the more pertinent parts of this communication are quoted as follows:

“Now as regards the article in the *Review*,¹ on the 20th of May, 1922, the Society held a mango show, and a firm from South India sent his representative with 75 varieties of mangos for exhibition. Some weighed 5½ to 6 pounds (2,400 to 2,720 grams) and I was told that in normal years these fruits would weigh 8 to 9 pounds each (3,625 to 4,080 grams). The flavor was mild, insipid, and sweet but they were without fiber.

* * * As to mango varieties, this is where in India we are up against trouble. Most kinds have been propagated by seed, and in consequence there are many types of the same variety differing in shape, size, color, and flavor.

¹ Referring to Bulletin No. 36, *A Descriptive List of Mango Varieties in India*, originally published in this *Review*, Vol. XIII, pp. 265–352, 1920.

I happen to have the Indian nobleman who gave Dé his notes re the mangos² on the council and spoke to him pointing out the descriptions as they appear in your article. He says that Dé has made many errors. I am making a few corrections, but would refer you to my own notes on these mangos.

Ajwanea is not worth cultivating and is of rather unpleasant flavor, like *Carum copticum* (Damoro).

Alphonso. This has been confused with Pairi, Peterpasand and Bombay. The genuine Alphonso has no beak, (nak), is deep orange in color, thin skinned, and very aromatic.

Atai is a late mango.

Baramashi, (*Baromasia*), though the name is spelt in various ways, is a twice bearing variety annually; in fact one can often get three crops of fruit in one year. It is also called *Dophallia*, "twice bearing," and occasionally separated from *Baramashi*. It has no special merit except that of productiveness.

Belua I have not heard of, but know *Bael Khas* which seems to answer to the description.

Bira is oblong in shape, fiberless, of excellent flavor and very sweet. The original tree is in Bhagwangola.

Bombay. Here again we have a multitude of varieties from seedlings which are apt to puzzle one. The true Bombay shape is given in Figure No. 12, in your article.³ Though the color varies from green to yellow, the fruit is usually marked with pale yellow dots, which are the chief distinguishing marks. *Bombay, Dr. King*, is a doubtful Bombay for I have tasted it.

The *Brindabani* I had from Malda was an excellent variety and equaled any Bombay variety in flavor.

Bulbulchasm is only grown as a curiosity, for the color of the fruit is very striking, being scarlet like the flower of *Coccinea indica*. It is of ordinary flavor.

Enuria is supposed to be a spontaneous hybrid between *Fazli* and *Langra*.

Fazli, *Fasli*, and *Fajri*, are variations in name of the same variety but have somehow got distributed as quite distinct types of fruit.

Kachamitha. There must be a dozen different shapes and sizes that are so called, which signifies that the fruit is sweet even when unripe. It is not worth cultivating, for most of those kinds are insipid when ripe.

² Numerous descriptions in my article were quoted from *A Treatise on Mango*, 1904, by P. C. Dé.

³ See this *Review*, Vol. XIII, p. 279, 1920.

Kishenbogh and *Krishnabhog* are synonyms.

Langra. Here again we have many variations, but they all resemble one another in shape and flavor, differing in period of fruiting and color.

The true *Malda* is a really fine fruit, but among Europeans the name is used to designate the large fruited kinds of insipid taste, hence a lot of confusion exists.

Sandersha is also a name that has been given to two distinct varieties. Your Plate XVIII shows what is here known as *Polly*, *Totapari* and *Collector*, and I have just got another fruit from a firm in South India, named *Kilimookoo*, which is the same variety.

Sandurea is identical with *Sindurea*, so named because the fruit is usually splashed with red, the color used by the Hindoos for the *Pooja* marks. Some varieties have received this name from the fancied Sandalwood flavor of the fruit.

Sarvati and *Sharbati* are identical, meaning sirupy, and are "sucking" mangoes; i. e. they contain too much fiber to be eaten with a spoon but are used as a juicy "sucking" fruit.

Stalkart and *Peters* are both types of *Bombay*.

Some of the vernacular names signify shape, weight, etc., and I give these, too, in case you care to keep a record of them as follows:

Amirgola and *Ameercola* are the same name though attached to different varieties.

Amrita-bhog means nectar food.

Monda means a sweetmeat.

Anarua like the pomegranate.

Aswina means ripening in October.

Batasa is a late variety, and like a flattened sweetmeat of that name.

Bhadoe, *Bhadurea*, *Budaya* and *Bhadai*, etc., means ripening in September.

Chapta or *Chapte* means flat.

Champa refers to the flower of *Michelia champaca*.

Chickna means smooth.

Chini sukker means sweet, as white clarified, and red, unclarified sugar, together.

Dadh or *Dudh* is milk, referring to the color of the flesh.

Doanti means two-seeded.

Gajria means carrot-like.

Gola means round.

Golab-khas means true rose, and

Golab bash scented like a rose.

Guria or *Gooria* means like unclarified, red sugar which is sold in lumps, before it is converted into "sukker," which is grainy.

Hsapeti is the same as *Ilsapati* or *Hilsapati*.

Jalibhanda means tied with netting, referring to the netted marking on the inside of the skin.

Kachmahua might refer to the unripe fruit of *Bassia latifolia*, (Mahua) but of this I am not quite certain.

Kakaria, *Kakoria*, and *Kakria* means cucumber-shaped.

Kala is black.

Kalua like a plantain or banana.

Karbhuza, etc., like a cantaloupe, *Cucumis melo*.

Karelia means like *Momordia charantia*.

Kapuria, like camphor.

Kartika, fruiting in November.

Kath-ambi means acid mango.

Khajha, like a sweetmeat of that name.

Khaparia, like a head.

Kumrajali, as large as a pumpkin, netted.

Kysapati is: What a leaf! meaning rather vague.

Ladua, like a round sweetmeat of that name.

Lamba Bhadra is a long fruit borne in September.

Lat-Kampi, Lord of the plains.

Lerrua is also known as *Ladua*.

Madhua, like honey.

Mithua, sweet.

Misribhog, sweet food.

Misrikund, sweet, like crystallized sugar, candy.

Mulgoa and *Mulgoba* are identical names though applied to distinct varieties.

Nakua and *Nucka*, with a nose or *nak*, *daghi* marked.

Naspati, apple-like.

Pansera, weighing five seers, or 10 lbs.

Peters is a Bombay variety.

Rang bahar means showy color.

Safeda or *Sabza*, white or whitish.

Singra, like a horn.

The mango is a pretty large subject (and I suppose that were I to live to be a hundred years old and managed to get in touch with every province in India, still there would be some good varieties overlooked. I thought that when I had made descriptions of my first 100 varieties I knew all the different sorts of

mangos in India, but now I have a list of some 500 kinds—of which, however, there are a good many synonyms and seedling variations—and am now moving on the six hundreds, and “still there are more to follow.”

The descriptions of the fruits in the two lists by Burns and Prayag, and by Percy-Lancaster, are more detailed than any previously published by Anglo-Indian writers, and so give the reader a better idea of what India has in the way of mangos than do previous publications on the subject from that country. But they also confirm my previously expressed opinion that a large number of the mango varieties in India are mere curiosities of very little commercial value. For instance, of the 89 varieties included in the list by Burns and Prayag 21, or nearly one-fourth, do not reach 200 grams in weight, four weigh less than 100 grams and two less than 75 grams. For comparison it may be said that the average weight of the Philippine Carabao mango is 230 grams, with a maximum of 560 grams, and that of the Pico mango 215 grams, with a maximum of 460 grams, while the Pahutan averages 96 grams in weight. Many of the varieties described are said to be fibrous, of poor quality, turpentiney, or to have a disproportionately large seed; others have an uncouth unattractive form. No mention is made of the prevalence of fiber in many sorts which leaves one in doubt as to the real merit of the fruit. Considering the number of good fiberless varieties available, certainly no mango so fibrous that it cannot be eaten with a spoon has a future, and it is believed that only in the case of exceptionally good varieties would fruits weighing less than 200 grams be acceptable in the trade when mango growing shall have become an organized industry.

In the within article mangos weighing less than 200 grams are classed as small; they are classed as of medium size when they weigh from 200 to 500 grams; large, when they weigh from 500 to 900 grams; and very large when they exceed the latter weight.

As being of value to prospective importers and planters of mangos, and complementing my previous list, the following brief descriptions have been adapted from the two publications referred to in the belief that they are the “cream” enumerated and described therein.

The following varieties listed by Burns and Prayag in *The Book of the Mango*:

Dalimbya (from *Nandgaon*).—A medium large fruit, weighing 354 grams, deep yellow to light orange; flesh fiberless and of good flavor; seed small, 32 grams in weight.

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|| of India
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Dalimbya (from *Khed-Shivapur*).—A medium sized fruit weighing 300 grams, orange to pomegranate-red; flesh fiberless and of good quality; seed small, 29 grams in weight.

Kelya.—A medium sized fruit with a prominent beak, weighing 326 grams, yellow; flesh of excellent flavor; seed small, 30 grams in weight.

Madan-Ban.—A large fruit, weighing 584 grams, yellowish green; flesh fiberless and of excellent flavor; seed comparatively small, weighing 37 grams.

Pairi.—A medium sized, short-ovoid fruit, weighing 360 grams, green to yellow, bright red on sun exposed shoulder; flesh almost fiberless, and of excellent flavor, but of poor keeping quality.

Rawanya.—A heartshaped fruit of medium size, weighing 355 grams, green, shaded with canary yellow; flesh of excellent flavor; seed small, 31 grams in weight.

Among the varieties described by Percy-Lancaster in the *Proceedings and Journal of the Agricultural and Horticultural Society of India*, the following sorts would appear to be the best. The numbers in parenthesis are those given to the corresponding varieties in the said publication:

Alipasand (291).—A medium sized, oval-falcate fruit, 90 millimeters long, 63 millimeters in diameter, weighing from 285 to 480 grams, deep lemon; flesh very sweet and aromatic, of delicious flavor recalling the guava; seed thin.

Amritsar (66).—A short-oblong fruit of medium size, 90 millimeters long, averaging 283 grams in weight, greenish yellow, with bright yellow cheeks and a small conspicuous beak; flesh fiberless, soft, very sweet, and of delicious flavor.

Barashia (270).—An ovoid fruit, 115 millimeters long, 100 millimeters across, weighing from 285 to 455 grams, dark orange; flesh very sweet, of peculiar pleasant flavor, fiberless; seed thin.

Batajora (194).—An oblong-ovoid fruit, 140 millimeters long, 75 millimeters in diameter, weighing an average of 425 grams, with a prominent, pointed beak, and dull, dark green skin; flesh firm, sweet and fiberless, with a large proportion of flesh to the seed; seed long and very thin.

Bele Pratab (157).—A medium sized, ovoid fruit with distinct beak, 100 millimeters long, 75 millimeters in diameter, weighing 227 to 283 grams, orange yellow; flesh soft, very sweet, of delicious, delicate flavor; seed very thin, flattened at the base.

Bettiah (*Bombay Bettiah*) (39).—A round-ovoid, large fruit, from 565 to 850 grams in weight, orange colored to tinged with

green, and black dots; flesh firm, very sweet, and of delicious flavor.

Bhoota Bombay (11).—An almost round fruit of medium size, weighing 311 grams, very green to yellowish at apex; flesh fiberless and of excellent flavor; seed long and very thin.

Bogol-Sha (273).—An oblong-oval, medium sized fruit, 140 millimeters long, 75 millimeters broad, weighing 283 to 455 grams, deep orange shading to green; flesh sweet, of delicious flavor, somewhat resembling Bael, *Aegle marmelos*, aromatic; seed thin.

Calcutta (Maldah) (89).—A medium sized to large, ovoid fruit, 125 millimeters long, 100 millimeters in diameter, weighing 340 to 510 grams, bright yellow shading to vermillion at base; flesh fiberless, firm, and sweet, with an agreeable acid flavor; seed of average size, thin at base.

China Fusli (317).—A rather small to medium, oblong-oval fruit, 115 millimeters long, 90 millimeters in diameter, averaging 285 grams in weight, greenish to yellow on the sides; flesh firm, sweet, melting and of fine flavor; seed thin.

Chota Jehangir (345).—An ovate fruit of medium size, 125 millimeters long, 100 millimeters broad, weighing 285 to 340 grams; lemon chrome tinged with green; flesh very sweet and luscious, fiberless; seed very small.

Damancha (96).—A medium sized to large fruit, 100 millimeters long, 75 millimeters broad, weighing 340 to 565 grams, with bright yellow cheeks, shading to green; flesh fiberless, very sweet and of delicious flavor; seed thin.

Dharma, (Sufaida, Derrima, Durma, Chapta) (87).—An ovoid fruit of medium to large size, 340 to 510 grams in weight; flesh almost free from fiber, firm and sweet, with the flavor of vanilla; seed of average size.

Dilpasand (266).—A medium sized fruit with distinct beak, 125 millimeters long, 90 millimeters across, weighing from 283 to 453 grams, orange colored; flesh very sweet and of delicious flavor, fiberless, quite aromatic; seed of average size.

Fusli (16).—An oblong-ellipsoidal, medium to large fruit, from 285 to 900 grams in weight, dark-green; flesh firm and sweet, with a tinge of acid.

Golab Khas (115).—An ovoid, handsome fruit of medium size, 88 millimeters long, 63 millimeters in diameter, weighing 255 to 340 grams, pale green, flushed with scarlet, and white dots; flesh almost devoid of fiber, firm, sweet and aromatic, and of excellent flavor; seed thin.

Himayuddin (278).—A medium to quite large, oval fruit, sometimes 150 millimeters long, and 115 millimeters in diameter, weighing from 285 to 565 grams, bright orange shading to greenish yellow; flesh very sweet and luscious and in large proportion to the seed, which is very thin.

Jalal Sahib (340).—A medium sized, oblong-falcate fruit, 165 millimeters long, 115 millimeters in diameter, averaging 395 grams in weight, greenish yellow to chrome yellow on the cheeks; flesh firm, subacid, of delicious flavor, fiberless, seed of average size.

Kalamocha (271).—A medium sized to quite large fruit, 140 millimeters long, 90 millimeters broad, weighing from 455 to 565 grams, dark orange; flesh very sweet, aromatic, of fine flavor, slightly fibrous; seed thin.

Kysapati (12).—A medium large, ovoid fruit weighing from 340 to up to 425 grams, with a prominent beak, lemon yellow to greenish at base; flesh fairly firm and of fine flavor.

Langra (43).—An almost round, rather large mango, 10 centimeters long, 90 millimeters across, weighing 567 to 680 grams, yellow, tinged with green; flesh firm, and subacid in flavor; seed very thin.

Latkumpu (*Lat Kuspu*, *Mahadeb Prasad*) (33).—An ovoid-oblong, rather large fruit, weighing 453 to 735 grams, orange yellow to greenish; flesh slightly fibrous, firm, sweet, with the flavor of *Dillenia indica*.

Mulgoa (183).—The fruit is nearly round, 90 millimeters in diameter, 340 to 510 grams in weight, thick-skinned, greenish yellow with cream colored dots; flesh firm, very sweet and of delicious flavor; seed of average size. Reputed one of the best south Indian varieties.

Nadam (*Pasund*) (248).—An oblong-oval fruit, 140 millimeters long, 90 millimeters across, weighing 283 to 340 grams, orange colored, shaded with green at base, the skin thick; flesh firm and juicy, very sweet, of delicious flavor, very aromatic and fiberless; seed thin.

Nanihar (290).—An oblong oval, medium sized to quite large fruit, 140 millimeters long, 90 millimeters across, and 340 to 565 grams in weight, yellow shading to yellowish green; flesh very sweet and of excellent flavor; seed thin.

Nardusalai (201).—A medium sized, round fruit, 90 millimeters in diameter, weighing 340 grams, with distinct beak, green to deep chrome shaded with scarlet; flesh very sweet, highly aromatic, of good flavor and fiberless; seed small and thin.

Nawab Khas? (165).—A large to very large, almost round fruit, 125 millimeters long, 120 millimeters across, weighing from 450 to 1,370 grams; chrome yellow to pale green; flesh very juicy and sweet, with enough tartness to make it very fine flavored; seed thin, "depressed" at base and apex.

Nazak Badam (277).—A medium sized, oval fruit, 140 millimeters long, 115 millimeters across, weighing 285 to 453 grams, dull orange; flesh firm, very sweet, and very delicately flavored; seed small.

Pride of Russa (334).—An oval, yellowish green, fairly large fruit, 115 millimeters long, 90 millimeters across, averaging 310 grams in weight; flesh sweet, juicy and luscious; seed thin.

Radha Bhog (159).—A medium sized, ovoid fruit with a pointed beak, 100 millimeters long, 75 millimeters across, weighing 227 to 283 grams, greenish yellow to deep yellow; flesh soft, a trifle acid, and of pleasant flavor; seed thin.

Sodale (319).—A fair sized, oblong-oval fruit, 115 millimeters long, 85 millimeters across, averaging 310 grams in weight; flesh very sweet and of delicious flavor; seed small and thin.

Suka (*Sooka*, *Laddowa*) (37).—A round, medium sized to large fruit, 283 to 567 grams in weight, dull yellow tinged with pale green; flesh slightly fibrous, and subacid in flavor.

Tenneru (338).—A very large, ovate fruit, 190 millimeters long, 140 millimeters in diameter, weighing from 850 to 1,135 grams, yellow, shaded with orange and green; flesh soft in texture, of pleasant subacid flavor, fiberless; seed long and thin.

Umrao Pasand (*Sha Pasand*) (2).—An ellipsoidal, reddish orange to pale green fruit of medium size, weighing 311 grams; flesh fiberless, firm, and of excellent flavor.

Reviewing then, the descriptions of the grafted mango varieties in the publications mentioned in the within paper it would appear that the following are the best and most worth introducing for trial where they are not now grown:

Alfonso (several varieties)	Bhaisht
Alipasand	Bira
Amini	Bogol-sha
Amiri	Bombay (several varieties)
Amritsar	Bulbulchasm (as fruited in Porto Rico)
Barashia	Calcuttia
Batajora	Cambodiana
Bele Pratab	China-Fuzli
Benarsi	Chota Jehangir
Bennett	Dadh mungo
Bettiah	

Dalimbya	Langra (several varieties)
Damancha	Latkumpu
Dilpasand	Mohunbhog
Dilsaj	Madan-Ban
Durgabhog	Mulgoa
Durma (Syn. Sufaida, Derrima, Dharma, Chapta.	Mulgoba
Fajri Long	Nadam
Faqirwala	Nanihar
Fuzli (Fusli)	Nardusalai
Golab-Khas	Nawab Khas
Haden	Nazak-Badam
Hathijuhl	Pairi
Himayudin	Pride of Russa
Itamaracá	Radha Bhog
Jalal-Sahib	Rawanya
Kalamocha	Sandersha
Kalapahar	Sabza
Kartika	Shapasund
Kathambi	Singapuri
Kelya	Sodale
Khaparia	Souria
Kishenbhog	Suka
Kohitur	Surkha
Kysapati	Tenneru
Laldarma	Totapari
	Umrao Pasand

CURRENT NOTES—FOURTH QUARTER

'Notes by P. J. WESTER

AN EXPERIMENT IN FORCING MANGOS

Smudging mango trees to drive away the mango hopper, *Idiocerus spp.*, and force the trees into fruiting, has long been a common practice in the principal mango district near Manila, and the practice is described and illustrated in Bulletin No. 18, *The Mango*, Revised edition, published by this Bureau. In the *Philippine Agriculturist*, Vol. XII, No. 1, 1923, Mr. Leon G. Gonzales relates his experience in an experiment undertaken to study the effect of smudging the trees and the relation thereof to insect control. Altogether, forty trees were used in the experiment which demonstrated that:

1. The mango can be made to flower by means of smudging at any time of the year, provided the tree is in proper condition.
2. The heat, not the smoke, causes the flowering.
3. The number of flowers produced is directly proportional to the increases in temperature within the limits of safety from burning the leaves.
4. If smudges of less intensity of heat are used, the length of time of smudging should be proportionately increased before flowers will appear and under such circumstances flowering is likely to be less abundant.
5. Smoke drives away the mango hoppers, but they return immediately after the smudging is stopped.
6. The best time for smudging is between October and December, depending upon weather conditions. Smudging should not be done until the rains are over and the weather is settled.
7. Results from smudging are most easily obtained when the last growth is well matured and the terminal buds are well formed.

A SEEDLESS GUAVA

Slowly but surely the fruits of the tropics are being improved. We have learned to propagate many species vegetatively within the last fifteen years that previously were grown from seed as a matter of course, and so are in a position to take advantage of and propagate the exceptional individuals that spring forth now and then among the vast multitude of seedling fruit trees found in the tropics.

So we have found in the Philippines a number of seedless pomelos, mabolos and lanzones, sweet santols, sweet carambolas and kamias:

In the *Proceedings and Journal of the Agricultural and Horticultural Society of India*, for July–December, 1918, the Secretary, Mr. S. Percy-Lancaster, calls attention to a seedless guava of large size which he has discovered in India. This is the first time that a seedless fruit of this species has come to our attention and it is certain to be appreciated by all lovers of the guava who are familiar with the extraordinary seediness of the ordinary guava. There should be no difficulty in rapidly increasing and disseminating this valuable new variety as it has been found that the guava is easily shield-budded if the work is done during the dry season, here from November to May.

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